SAPTHAGIRI NPS UNIVERSITY
UNMATCHED EXCELLENCE, UNLIMITED POTENTIAL

SCHOOLOFAPPLIEDSCIENCE

BACHELOR OF COMPUTER APPLICATIONS
Specialization
in
Artificial Intelligence and Machine Learning

CURRICULUM

BATCH:2024-2027

SAPTHAGIRI NPS UNIVERSITY
#14/5– Chikkasandra– HesarghattaMainRoad– Bangalore–560057

About the University

Sapthagiri NPS University (SNPSU) stands at the forefront of multidisciplinary education– offeringcutting-edgeprogramsfocusedoninstillingdeepknowledge– problem- solving skills– leadership– and effective communication through innovative methods. The University is geared to scale and sustain the challenges of higher education in India. To impartqualityandexcellenceineducationunderMedicine– Engineering– AppliedSciences– BusinessStudies– ManagementStudiesetc.theUniversityhasworldclassstate-of-theart infrastructure.

About the School of Applied Science

The School of Applied Science was established in 2024 stated with two programs– Bachelor of Computer Applications and Master of Computer applications with the specialization of DataScience– Artificial Intelligence and Machine learning– CyberSecurity– Forensics– and Cloud Technology. The main objective is to produce high quality professionals to meet the demands of the emerging field of Applied Science and Computer Applications.

OURVISION

Offer a transformative impact on society through unique learning experience in Engineering Technology– Medicine– Applied Sciences– Business Studies– Management Studiesandotherareasofscholarshiptothestakeholderstoanunparallelededucational journey to serve the world and betterment of mankind.

OURMISSION

- To provide a student centric-learning environment focused on deep disciplinary knowledge– problem solving– leadership– communication– interpersonal skills through innovative pedagogy and education reforms.
- To generate outstanding leaders in the field of health sciences and to provide optimum human patient-centered health care of the highest quality.
- To create and sustain a community of lifelong learners in an environment that emphasizes literacy– critical and innovative thinking– humanity– scientific inquiry and to promote patriotism and moral values.
- To impact in a transformative way… regionally– nationally– and globally to face the economic– social and health related challenges for nation building.

- To accomplish quality assurance– enhancement and sustenance in academics and research for a fair and social justice by providing equal opportunity.

QUALITYPOLICY

We at SNPSU strive to deliver continually enhanced– global quality in Medical– Technical– AppliedScience– BusinessandManagementeducationthroughanestablished Quality Management System complemented by the synergistic interaction of the stake holders concerned.

VISIONOFTHE SCHOOL

To envision developing internationally recognized school in academics– research activities and provide quality education for the students with good value system to serve the society and face challenges of the continuously changing world.

MISSIONOFTHESCHOOL

1. Totraineffectiveprofessionalsbyinnovativeteachingmethodologies– emphasizing on experiential learning– through industry integrated curriculum with state-of-the- art infrastructure.
2. To enhance and maintain the highest academic standard in teaching learning process and research.
3. Todevelopprofessionalsthroughholisticeducationandinculcateethics– discipline– integrity– and social responsibility.

Curriculum Course Credits Distribution

Sl. No	Types of Courses	No of Course	Total Credits
1.	Core Courses (CC)	16	54
2.	Program Core(PC)	7	26
3.	Ability Enhancement Compulsory Courses (AECC)	3	4
4.	Skill Enhancement Courses(SEC)	4	6
5.	Generic Elective (GE)	2	6
6.	Discipline Specific Elective(DSE)	3	9
7.	Project	1	11
8.	MOOC Courses	1	3
9.	Community Service Program(CSP)	1	1
10.	Non-Credit Courses(Value added Courses)	2	-
	TOTAL		**120**

SCHEMEFOR2024-2027BATCH

SEMESTER- I

Sl. No	Course Code	CourseTitle	Course Type	L	T	P	C
1.	24BCAAL101A	Kali Samskruthi	AECC	1	0	0	1
	24BCAAL101B	Kali Kannada					
2.	24BCAAL102	Communicative English	CC	2	0	0	2
3.	24BCAAL103	Mathematical Foundations for Computer Applications	CC	4	0	0	4
4.	24BCAAL104	Introduction to C Programming	CC	3	0	2	4
5.	24BCAAL105	Digital Computer Fundamentals	CC	3	0	0	3
6.	24BCAAL106	Introduction to Soft Skills	SEC	2	0	0	2
7.	24BCAAL107	Web Design and Development	CC	3	0	2	4
TOTAL				**18**	**0**	**4**	**20**

SEMESTER– II

Sl. No	Course Code	CourseTitle	Course Type	L	T	P	C
1.	24BCAAL201	Discrete Mathematics	CC	3	0	0	3
2.	24BCAAL202	Programming in Python	CC	3	0	2	4
3.	24BCAAL203	Data Structures using C	CC	3	0	2	4
4.	24BCAAL204	Database Management Systems	CC	2	0	2	3
5.	24BCAAL205	Operating Systems with Unix	CC	3	0	0	3
6.	24BCAAL206	Quantitative Aptitude and Logical Reasoning	AECC	2	0	0	2
7.	24BCAAL207	Indian Constitution	SEC	1	0	0	1
TOTAL				**17**	**0**	**6**	**20**

SEMESTER–III

Sl. No	Course Code	Course Title	Course Type	L	T	P	C
1.	24BCAAL301	Statistical Methods and Techniques	CC	3	0	0	3
2.	24BCAAL302	Object Oriented Programming using Java	CC	3	0	2	4
3.	24BCAAL303	Fundamentals of Artificial Intelligence	PC	2	0	2	3
4.	24BCAAL304	Design and Analysis of Algorithms	CC	2	0	2	3
5.	24BCAAL305	Fundamentals of Machine Learning	PC	2	0	2	3
6.	24BCAAL306	Environmental Studies	AECC	1	0	0	1
7.	24BCAALE11/15-	Elective–1	GE	-	-	-	3
TOTAL				**13**	**0**	**8**	**20**

SEMESTER –IV

Sl. No	Course Code	Course Title	Course Type	L	T	P	C
1.	24BCAAL401	Multivariate Statistics	CC	3	0	0	3
2.	24BCAAL402	Introduction to Data Science	PC	3	0	2	4
3.	24BCAAL403	Computer Networks	CC	3	0	2	4
4.	24BCAAL404	Software Engineering	CC	3	0	0	3
5.	24BCAAL405	Professional Communication and Ethics	SEC	2	0	0	2
6.	24BCAAL406	Intellectual Property Rights- IPR	SEC	1	0	0	1
7.	24BCAALE42-	Elective-2	DSE	-	-	-	3
TOTAL				**15**	**0**	**4**	**20**

SEMESTER-V

Sl. No	Course Code	Course Title	Course Type	L	T	P	C
1.	24BCAAL501	Natural Language Processing	PC	3	0	2	4
2.	24BCAAL502	Deep Learning	PC	4	0	0	4
3.	24BCAAL503	ProjectPhase-1	Project	0	0	0	3
4.	24BCAALE3-	Elective–3	DSE	-	-	-	3
5.	24BCAALE4-	Elective–4	DSE	-	-	-	3
6.	OEcode	OpenElective	GE	-	-	-	3
TOTAL				**6**	**0**	**4**	**20**

SEMESTER–VI

Sl. No	Course Code	Course Title	Course Type	L	T	P	C
1.	24BCAAL601	Social Media Analytics	PC	3	0	2	4
2.	24BCAAL602	Advanced Artificial Intelligence and Machine Learning	PC	3	0	2	4
3.	24BCAAL603	Internship/Swayam/MOOC*	MOOC	3	0	0	3
4.	24BCAAL604	ProjectPhase-2	Project	0	0	0	8
5	24BCAAL605	Out Reach Activity	CSP	0	0	0	1
TOTAL				**9**	**0**	**4**	**20**

TOTALNO.OFCREDITS:120

PROFESSIONAL/ AIML ELECTIVES(DSE/GE)

ELECTIVE–I

Sl.No	Course Code	Course Title	Category	L	T	P	C
1.	24BCAALE11	User Interface and User Experience Design	GE	0	2	2	3
2.	24BCAALE12	Web Content Management	GE	3	0	0	3
3.	24BCAALE13	E-Commerce Application Development	GE	3	0	0	3
4.	24BCAALE14	Accounting and Financial Management	GE	3	0	0	3
5.	24BCAALE15	Data Visualization using Table au	GE	2	2	2	3

ELECTIVE–II

Sl. No	Course Code	Course Title	Category	L	T	P	C
1.	24BCAALE21	Linux Administration	DSE	0	2	2	3
2.	24BCAALE22	Computer Graphics	DSE	2	0	2	3
3.	24BCAALE23	Debugging and Testing	DSE	2	0	2	3
4	24BCAALE24	Distributed Computing for Data Science and AI	DSE	2	0	2	3
5.	24BCAALE25	Big Data Analytics	DSE	0	2	2	3

ELECTIVE–III

Sl.No	Course Code	Course Title	Category	L	T	P	C
1.	24BCAALE31	Data Engineering	DSE	0	2	2	3
2.	24BCAALE32	Block Chain Technology	DSE	3	0	0	3
3.	24BCAALE33	Statistical Machine Learning Algorithms	DSE	2	0	2	3
4.	24BCAALE34	R-Programming	DSE	0	2	2	3
5.	24BCAALE35	Edge Computing	DSE	2	0	2	3

ELECTIVE–IV

Sl.No	Course Code	Course Title	Category	L	T	P	C
1.	24BCAALE41	Reinforcement Learning	DSE	2	0	2	3
2.	24BCAALE42	Design and development of RPA	DSE	2	0	2	3
3.	24BCAALE43	Business Intelligence	DSE	2	0	2	3
4.	24BCAALE44	Information Security	DSE	2	0	2	3
5.	24BCAALE45	Applications of Neural Networks	DSE	3	0	0	3

***L: Lecture T:Tutorial P:Practical**

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**				Program Code	**24BCABAL**	
	Course	**Statistical Methods and Techniques**				Course Code	**24BCAAL301**	
	Semester	**III**	Credits	**3**	Theory / Practical	Total Hours	**45T**	
					3 / 0			

COURSEOBJECTIVES:

1) To impart to students– an assured level of competence or understanding the basic ideas– terms and language of statistics.
2) Todeterminethemean– medianandmodefromthedatapresentedinatableorgraph. To judge the reliability of measures of central tendency and to identify the causes of variability with a view to control.
3) To understand the variability of the time series.
4) Tounderstandmeaning– importanceandmethodofconstructingindexnumber.
5)

General Instructions for Teaching-Learning:

1) In addition to the traditional lecture method– different types of innovative teaching methods maybe adopted so that students will develop theoretical and applied mathematical skills.
2) To support and guide the students for self-study.
3) To state the need for mathematics with engineering studies and provide real-life examples.
4) To encourage the students for group learning and to improve their creative and analytical skills.
5) Responsible for assigning home work–grading assignments and quizzes.

Module	Topics	Hours
I	**Introduction to Statistics** Introduction to Statistics– Definition– Limitations– Scope– Characteristics– Sourceofdata–Classification–Diagrammaticandgraphicrepresentationof data– Advantages and limitations of diagrammatic & graphs– Tabulation (only construction)–Histogram–Frequency curve–Ogive method– Problems.	9
II	**Measures of Central Tendency** Measures of Central Tendency– Introduction– Meaning and Definition– Objective of Central Tendency– Types of Averages– Arithmetic mean including one missing frequency (Direct method and Step deviation method)–Median including one missing frequency–Mode and its implications.	9
III	**Measures of dispersion(Variance)** Measures of dispersion–Introduction–Definition–Merits and Demerits– Quartile deviation– Mean deviation (Mean & Median)– Standard deviation– Coefficient of Variance– Skewness and Kurtosis – Problems.	9
IV	**TimeSeries** Time Series–Concept of time series–Definition–Components of time series– Applications of time series– Trend analysis– Least square method that is linear & non-linear– Moving averages (2– 3– 4 & 5).	9
	Index Number	9
V	Index Number– Meaning– Types of index number– Uses & applications of index number– Computation of index number– Value index number– Price index number– quantity index number– Time reversal test– Factorial reversal test– Chain base & Consumer price index number.	

COURSEOUTCOMES:

At the end of course the students will be:

CO1:Abletounderstandthebasicknowledgeondatacollectionandvariousstatisticalelementary tools.

CO2:Abletocomprehendthemeasuresofvariousdistributionsandaverages.

CO3:Abletocalculaterange– inter-quartilerange– standarddeviationofmeasurementsofdispersion.

CO4: Able to knowthe basic concept of time series analysis– build appropriate econometric time series models.

CO5:Abletodescribetheindexnumberandappropriateitsusesinthereal-life.

TEXT BOOKS:

1.P. K. Mittal– B. G. Sathya prasad and M. K. Pradeep Kumar Rao– "Mathematics and Statistics for Management"– Himalaya Publications.

2.P.N.Arora– "QuantitativeStatisticalMethod"– SChandPublication– NewDelhi– 2018.

REFERENCEBOOKS:

1) S.C.Gupta– "FundamentalsofStatistics"– HimalayaPublications– 2019– Latest Edition.
2) N.D.Vohra– "BusinessStatistics"– TataMcGrawHill– 2018– LatestEdition.
3) ChikkodiandSatyaPrasad-Quantitativemethodsfor Business.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Object-Oriented Programming using Java**					Course Code	**24BCAAL302**
	Semester	**III**	Credits	**4**	Theory **3**	Practical **2**	Total Hours	**45T30P**

COURSEOBJECTIVES

1) To introduce the object-oriented programming concepts.
2) To understand object-oriented programming concepts– and apply them in solving problems.
3) To introducetheprinciplesofinheritanceandpolymorphism;anddemonstratehow they relate to the design of abstract classes
   To introduce the implementation of packages and interfaces
4) TointroducethedesignofGraphicalUserInterfaceusingappletsandswingcontrols
5)

Module	Topics	Hours
I	**Introduction to Java:** Overview of Java– JVM– Basics of Java programming– Data types– Variables– Operators– Control structures including selection– Looping– Java methods– Overloading– Math class– Arrays in java.	8
II	**Objects and Classes:** Basics of objects and classes in java– Constructors– Finalizer– Visibility modifiers– Methods and objects– Inbuilt classes like String– Character– String Buffer– File– this reference.	9
III	**Inheritance and Polymorphism:** Inheritance in java– Super and sub class– Overriding– Object class– Polymorphism– Dynamic binding– Instanceof operator– Abstract class– Interface in java– Package in java– LANG and UTIL package.	8
IV	**Event and GUI programming:** Event handling in java– Event types– Mouse and key events– GUI Basics– Panels– Frames– Layout Managers: Flow Layout– Border Layout– Grid Layout– GUI components like Buttons– Check Boxes– RadioButtons– Labels– TextFields– TextAreas– ComboBoxes– Lists– Scroll Bars– Sliders– Windows– Menus– Dialog Box– Applet and its life cycle	10
V	**I/O programming:** Text and Binary I/O– Binary I/O classes– Object I/O– Random Access Files. Multithreading in java: Thread life cycle and methods– Runnable interface– Thread synchronization– Exception handling with try catch finally.	10

COURSEOUTCOMES

At the end of the course students will be–

CO1:Explain the object-oriented concepts and JAVA Write JAVA programs using OOP concepts like Abstraction– Encapsulation–

CO2:Demonstrate the basic principles of creating Java applications with GUI. CO3: Implement Classes and multithreading using JAVA.

CO4:Inheritance and Polymorphism.

CO5:Event and GUI programming.

TextBooks
1EBalagurusamy“ProgrammingwithJava |7thEdition”McGrawHill2023. 2JavaThecompleteReference– 7thEditionHerbertSchildt 2017.
ReferenceBooks
1ProgrammingwithJava– ByEBalagurusamy –APrimer– 4thEdition– McGrawHillPublication. 2. CoreJavaVolumeI–Fundamentals– ByCayS.Horstmann– Prentice Hall. 3. ObjectOrientedProgrammingwithJava:SomashekaraM.T.– Guru– D.S.– ManjunathaK.S– 1st Edition– PHI Learning 2017. 4. Java2-TheCompleteReference– HerbertSchildt– 5thEdition– McGrawHillPublication– 2017. 5. Java-TheCompleteReference– HerbertSchildt– 7thEdition– McGrawHillPublication– 2017.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Fundamentals of Artificial Intelligence**					Course Code	**24BCAAL303**
	Semester	**III**	Credits	**3**	Theory **2**	Practical **2**	Total Hours	**30T30P**

	COURSEOBJECTIVES
1)	To impart knowledge about basic computer fundamentals and programming environments required for implementing Artificial Intelligence (AI) systems.
2)	Toenablethestudentstounderstandthehistoryof AIandthebasicprinciplesof modern AI.
3)	Toenablestudentstolearntheinformedanduninformedsearchmethods– anda simple evolutionary algorithm for solving problems.
4)	Toenablethestudentstounderstandimportantmachinelearning(ML)algorithms used for improving various components of an AI agent
5)	To enable the student to understand ethics in AI
	General Instructions for Teaching-Learning Process
1)	PPT– Creative thinking– Flipped Learning– Problem Based learning Enhance
2)	students knowledge with statistical and mathematical concepts Provide
3)	opportunities for hands-on experience with AI tools and techniques.
4)	Emphasizeproject-basedlearningtoprovidestudentswithpracticalexperiencein developing AI.

Module	Topics	Hours
I	**Introduction** AI problems –foundationof AI and history of AI intelligent agents: Agents and Environments–the concept to frationality–the nature of environments – structure of agents – problem solving agents – problem formulation.	6
II	**Problem Solving by Searching** Searching for solutions – uniformed search strategies – Breadth first search – depth first Search – Search with partial information (Heuristic search) Hill climbing – A* – AO* Algorithms – Problem reduction – Game Playing-Adverbial search – Games – mini-max algorithm – optimal decisions in multiplayer games–Problem in Game playing–Alpha-Beta pruning–Evaluation functions.	6
III	**Knowledge Representation** Knowledge representation issues –predicatelogic–logic programming– semantic nets frames and inheritance – constraint propagation – representing knowledge using rules – rules-based deduction systems – Reasoning under uncertainty – review of probability– Baye's probabilistic interferences and dempster Shafer theory.	6
IV	**First order logic** Firstorderlogic–Inferenceinfirstorderlogic–propositionalvs.firstorder inference – unification & lifts forward chaining – Backward chaining – Resolution –learning from observation Inductive learning –Decision trees – Explanation based learning – Statistical Learning methods – Reinforcement Learning.	6
	Expert systems	

V	factors – types of expert systems – expert systems and the internet interacts web– knowledge engineering–scope of knowledge–difficulties– in knowledge acquisition methods of knowledge acquisition – machine learning – intelligent agents – selecting an appropriate knowledge acquisition method – societal impacts reasoning in artificial intelligence – inference with rules – with frames: model based reasoning – case based reasoning–explanation &meta knowledge inference with uncertainty representing uncertainty.	6

COURSEOUTCOMES

At the end of the course students will be–

CO1:To understand the basic idea of artificial intelligence and its application areas.

CO2:ToapplybasicprinciplesofAIinsolutionsthatrequiresproblemsolving– inference– Perception– knowledgerepresentation– andlearning.

CO3:Todemonstrateawarenessandafundamentalunderstandingofvariousapplicationsof AI techniques.

CO4:TounderstandaboutLogicprogrammingandaboutReasoningrelatedtoAI. CO5: To know about the different representational techniques in AI.

TextBooks

1. KevinNight– ElaineRich– andNairB.– "ArtificialIntelligence"– McGrawHill– 2017
2. M.TimJones– -ArtificialIntelligence:ASystemsApproach(ComputerScience)– Jonesand Bartlett Publishers Inc.; First Edition– 2008.
3. ArtificialIntelligence:AModernApproach– 4thedition– PublishedbyPearson2021Stuart Russell– PeterNorvig

ReferenceBooks

1. GerhardWelss– -MultiAgentsSystems– SecondEdition– 2013
2. Agents– CambridgeUniversityPress– 2010.
3. DanW.Patterson– "IntroductiontoAIandES"– PearsonEducation– 2007

	Program	**Bachelor Of Compute Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Design and Analysis of Algorithms**					Course Code	**24BCAAL304**
	Semester	**III**	Credits	**3**	Theory **2**	Practical **2**	TotalHours	**30T30P**

COURSEOBJECTIVES

1) Analyze the asymptotic performance of algorithms. Write
2) rigorous correctness proofs for algorithms.
3) Demonstrate a familiarity with major algorithms and data structures. Apply
4) important algorithmic design paradigms and methods of analysis.
5) Synthesizeefficientalgorithmsincommonengineeringdesignsituations.

Module	Topics	Hours
I	**Introduction:** What is an Algorithm? Fundamentals of Algorithmic problem solving – FundamentalsoftheAnalysisofAlgorithmEfficiency–AnalysisFramework – Measuring the input size –Units for measuring Running time –Orders of Growth – Worst-case –Bestcase and Average-case efficiencies.	6
II	**Asymptotic Notations** Asymptotic Notations and Basic Efficiency classes –Informal Introduction –O-notation –Ω-notation –θ-notation –mathematical analysis of non- recursive algorithms –mathematical analysis of recursive algorithms.	6
III	**Brute Force & ExhaustiveSearch** Introduction to Brute Force approach–SelectionSort and BubbleSort– Sequential search–ExhaustiveSearch-TravellingSalesmanProblemand Knapsack Problem –Depth First Search –Breadth First Search	6
IV	**Decrease-and-Conquer:** Introduction –Insertion Sort –Topological Sorting Divide-and-Conquer: Introduction –Merge Sort –Quick Sort –Binary Search –Binary Tree traversals and related properties.	6
V	**Greedy Technique** Introduction–Prim'sAlgorithm–Kruskal'sAlgorithm–Dijkstra'sAlgorithm – Lower-BoundArguments–DecisionTrees–PProblems–NPProblems – NPCompleteProblems–Challengesof NumericalAlgorithms.	6

COURSEOUTCOMES

At the end of the course students will be–

CO1: Understand the fundamental concepts of algorithms and their complexity– including time and space complexity– worst-case and average-case analysis – and Big-O notation.

CO2: Design algorithms for solving various types of problems– such as Sorting– Searching– Graph traversal – Decrease-and-Conquer – Divide-and-Conquer and Greedy Techniques.

CO3: Analyze and compare the time and space complexity of algorithms with other algorithmic techniques.

CO4: Evaluate the performance of Sorting– Searching– Graphtraversal– Decrease-and-Conquer – Divide-and-ConquerandGreedyTechniquesusingempiricaltestingandbenchmarking– and identify their limitations and potential improvements.

CO5:Applyvariousalgorithmdesign to real-world problems and evaluate theireffectivenessand efficiency in solving them.

TextBooks

1. AnanyLevitin– "IntroductiontotheDesignandAnalysisofAlgorithms"– 3rdEdition– Pearson– 2012.
2. Horowitz– Sahni– Rajasekaran– "FundamentalsofComputerAlgorithms"– 2/e– UniversitiesPress– 2007

ReferenceBooks

1. Thomas.H.Cormen– Charles E. Leiserson– RonaldL.Rivest– Clifford Stein– "Introduction to Algorithms"– 3rd Edition– The MIT Press– 2009.
2. A.V.Aho– J.E.Hopcroft– J.D.Ullmann– "ThedesignandanalysisofComputerAlgorithms"– AddisonWesley Boston– 1983.
3. JonKleinberg– EvaTardos– "AlgorithmDesign"– PearsonEducation– 2006.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Fundamentals of Machine Learning**					Course Code	**24BCAAL305**
	Semester	**III**	Credits	**3**	Theory **2**	Practical **2**	Total Hours	**30T30P**

COURSEOBJECTIVES

1) Tounderstandthebasictheoryunderlyingmachinelearning– types– andtheprocess.
2) Tobecomefamiliarwithdataandvisualizeunivariate– bivariateandmultivariatedatausing statistical techniques and dimensionality reduction.
3) Tounderstandvariousmachinelearningalgorithmssuchassimilarity-basedlearning regression– decision trees and clustering.
4) Tofamiliarizewithlearningtheoriesprobability-basedmodelsandreinforcementlearning– developing the skills required for decision-making in dynamic environments.
5) Toevaluateandoptimizemachinelearningmodelsbyanalyzingperformancemetricsand fine-tuning algorithms for improved results.

GeneralInstructionsforTeaching-LearningProcess

1) Lecturermethodneedsnottobeonlytraditionallecturemethod canmakeuseof digital tools to visually demonstrate key ideas that could be adopted to attain the outcomes.
2) Usethinkpair-sharestrategieswherestudentscollaborateinpairsorgroupstodiscuss concepts and solve small problems before sharing their understanding with the class.
3) Usecasestudiesthatapplymachinelearninginfieldslikefinance–healthcare–and marketing to reinforce practical applications.
4) AdoptProblemBasedLearning(PBL)whichfostersstudents'Analyticalskillsdevelop design thinking skills such as the ability to design evaluate generalize and analyze information.

Module	Topics	Hours
I	**Introduction to Machine Learning** Introduction to Machine Learning: Need for Machine Learning– Machine Learning Explained– Machine Learning in Relation to Other Fields– Types of Machine Learning– Challenges of Machine Learning– Machine Learning Process– Machine Learning Application. Understanding Data: Introduction– Big Data Analytics and Types of Analytics– BigDataAnalysisFramework–DescriptiveStatistics–Univariate Data Analysis and Visualization– Bivariate Data and Multivariate Data.	6
II	**UnderstandingData** Understanding Data: Multivariate Statistics– Essential Mathematics for Multivariate Data– Overview of Hypothesis– Feature Engineering and Dimensionality Reduction Techniques. Basics of Learning Theory: Introduction to Learning and its Types– Introduction to Computation Learning Theory–Design of a Learning System– Introduction to Concept Learning– Induction Biases– Modelling in Machine Learning.	6
	Similarity-based Learning and Regression Analysis	

III	Similarity based Learning: Introduction to Similarity or Instance-based Learning– Nearest-Neighbor Learning– Weighted K-Nearest-Neighbor Algorithm– Nearest Centroid Classifier– Locally Weighted Regression (LWR). Regression Analysis: Introduction to Regression– Introduction to Linearity–CorrelationandCausation– IntroductiontoLinearRegression– ValidationofRegressionMethods–MultipleLinearRegression–Polynomial Regression– Logistic Regression.	6
IV	**Models Basedon Decision Trees** Models Based on Decision Trees: Introduction to Decision Tree– Decision Tree for Classification– Impurity Measures for Decision Tree Construction– PropertiesofDecisionTreeClassifier(DTC)–ApplicationsinBreastCancer Data– Regression Based on Decision Tress**.** Bayesian Learning: Introduction to Probability-based Learning–Fundamentals of Bayes Theorem–Classification Using BayesModel.	6
V	**Clustering and Reinforcement Learning** Clustering**:** Introduction to Clustering– Clustering of Patterns– Divisive Clustering–AgglomerativeClustering–PartitionalClustering.Reinforcement Learning**:**OverviewandScopeofReinforcementLearning–Componentsof ReinforcementLearning–Q-Learning.	6

COURSEOUTCOMES

Attheendofthecoursestudents willbe

CO1: Demonstrate the need for machine learning its relationship to other fields and different types of machine learning

CO2: Apply similarity-based learning methods and perform linear polynomial regression analysis

CO3:Applydecisiontreesforclassificationandregressionproblemsand Bayesianmodelsfor probabilisticlearning

CO4:Illustratethefundamentalprinciplesofmultivariatedataandapplydimensionalityreduction techniques.

CO5: Analyze the clustering algorithms and reinforce their understanding by applying Q-learning fordecision making tasks

TextBooks

1. SSridharandMVijayalakshmi– "MachineLearning"– OxfordUniversityPress– 2021.
2. MNMurtyandAnanthanarayanaVS– "MachineLearning:TheoryandPractice"UniversitiesPress (India) Pvt. Limited– 2024.

ReferenceBooks

1. **"**MachineLearning:AProbabilisticPerspective**"**byKevinP.Murphy(MIT Press– 2022).
2. **"**IntroductiontoMachineLearning**"**byEthem Alpaydin(MITPress–2020).

	Program	**Bachelor of Computer Applications** **(Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Environmental Science**					Course Code	**24BCAAL306**
	Semester	**III**	Credits	**1**	Theory **1**	Practical **0**	Total Hours	**15T**

COURSEOBJECTIVES

1) Toexploreandunderstandthevarioustypesofnaturalresources. Explore and understand the environment and ecosystems.
2) To study population growth and its impact on environment. Knowledge and concept of biodiversity and its conservation.
3) Analyzepopulationimpact– resettlement– anddisastermanagement.

Module	Topics	Hours
I	**Ecosystems:** Forest– Desert– Wetlands– River– OceanicandLake.Biodiversity:Types– Value;Hot-spots;ThreatsandConservationofbiodiversity– ForestWealth– andDeforestation.	3
II	**AdvancesinEnergySystems:** Hydrogen– Solar– OTEC– Tidal and Wind. Natural Resource Management (Conceptandcase-studies):DisasterManagement– SustainableMiningand Carbon Trading.	3
III	**EnvironmentalPollution:** SurfaceandGroundWaterPollution;Noisepollution;SoilPollutionandAir Pollution.WasteManagement&PublicHealthAspects:Bio-medicalWastes; Solid waste; Hazardous wastes; E-wastes; Industrial and Municipal Sludge.	3
IV	**GlobalEnvironmentalConcerns:** Ground water depletion/recharging– Climate Change; Acid Rain; Ozone Depletion; RadonandFluorideproblem indrinking water; Resettlementand rehabilitation of people– Environmental Toxicology.	3
V	**HumanCommunitiesandtheEnvironment:** Human population growth: Impacts on environment– human health and welfare. Resettlement and rehabilitation of project affected persons; case studies. Disastermanagement:floods– earthquake– cyclones and landslides with case studies. Environment.	3

COURSEOUTCOME

Attheendofthecoursestudents willbe–

CO1:Define the multidisciplinary approach and nature that is for productivity of Differentecosystemsandecologicaldynamics.– sustainingofnaturalresources.

CO2:Explainthecurrentstatusofnaturalresources– habitatsandbiodiversity.

CO3:Describethetypesofenvironmentalpollutionandcontrolmeasures.Environmental policies and practices.

CO4:Interpretthehumandevelopmentandenvironmentalthreats.

CO5:Summarizetheenvironmentalethics– valuesandenvironmentalmovements.

TextBooks

1. Odum– E.P.– Odum– H.T.andAndrews– J.(1971).FundamentalsofEcology.Philadelphia: Saunders.
2. Pepper– I.L– Gerba– C.P.andBrusseau– M.L.(2011).EnvironmentalandPollutionScience. Academic Press.
3. RajitSenguptaandKiranPandey.(2021).StateofIndia'sEnvironment2021:InFigures.Centre Science and Environment.
4. Raven– P.H.– Hassenzahl– D.M.andBerg– L.R.(2012).Environment.8thEdition.JohnWiley&Sons.

ReferenceBooks

1. Bharucha– E.(2015).TextbookofEnvironmentalStudies.
2. Carson– R.(2002).SilentSpring.HoughtonMifflinHarcourt.
3. ClimateChange:ScienceandPolitics.(2021).ACentreforScienceandEnvironment(CSE)– Publication– New Delhi.
4. Gadgil– M.– and Guha– R. (1993). This Fissured Land: An Ecological History of India. Univ. of CaliforniaPress.5.Gleeson– B.andLow– N.(eds.)(1999).GlobalEthicsandEnvironment– London– Routledge.
6. Groom– MarthaJ.– GaryK.Meffe– andCarlRonaldCarroll.(2006).PrinciplesofConservation Biology. Sunderland: Sinauer Associates.
7. McCully– P.(1996).Riversnomore:theenvironmentaleffectsofdams(pp.29-64).ZedBooks

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Multivariate Statistical**					Course Code	**24BCAAL401**
	Semester	**IV**	Credits	**3**	Theory **3**	Practical **0**	Total Hours	**45T**

COURSEOBJECTIVES:

1) Tolearntheprocedureforcalculatingcorrelationandregression.
2) Tostudentsareabledefineexperiments– outcome– samplespace– eventsand problems involving probability distribution.
3) Toidentifythedifferencebetweendiscreteand continuous.
4) Tounderstandthelogicofhypothesistestingforfollowingrelatedconcept.
5) Todevelopstatisticalliteracy– skillsinstudentsinordertocomprehendandpractice statistical ideas.

GeneralInstructionsforTeaching-Learning:

1) In addition to the traditional lecture method– different types of innovative teaching methods maybe adopted so that students will develop theoretical and applied mathematical skills. Tosupportandguidethestudentsforself-study.
2) Tostatetheneedformathematicswithengineeringstudiesandprovidereal-life examples. Toencouragethestudentsforgrouplearningandtoimprovetheircreativeand analytical skills.
3) Responsibleforassigninghomework–gradingassignmentsandquizzes.
4)
5)

Module	Topics	Hours
I	**CorrelationandRegression** Correlation– Meaning & Definition– Uses– Applications– Types– Karl PearsonCoefficientofCorrelation(Deviationfromactualmean)–Sperman's Rank Correlation (With and Without repetitions). Regression– Meaning– Regression equation– Estimating x and y values– Finding coefficient of correlation with regression coefficient.	9
II	**ProbabilityandProbabilitydistribution** Probability– Random experiments– Outcomes– Sample spaces– Events– Occurrence of events– Exhaustive events– Mutually exhaustive events– Baye's theorem. Probability distribution– Introduction– Probability density function (Pdf)– Probability mass function (Pmf)– Binomial distribution– Poisson's distribution– Normal distribution– Exponential distribution.	9
III	**RandomVariable** Random Variable– Introduction– Discrete random variable– Continuous random variable–Jointprobabilitymassfunction–Marginalandconditional probability function– Joint probability distribution function– Mathematical expectations.	9
IV	**SamplingDistributionandEstimation** Samplingdistribution–Introduction–ParameterandStatistics–Principlesof Sampling– Types of Sampling– Sampling distribution of mean– Sampling Techniques. Estimation–Pointestimation–Intervalestimation–Hypothesistesting–Type I and Type II errors– Tail I and Tail II test– Formulation of hypothesis.	9

V	**Testingthe Hypothesis** Testing the hypothesis– Introduction– Chi-square distribution– Applications of Chi-square distribution– Chi-square test for goodness of fit– Analysis of Variance(ANNOVA)–One-wayANNOVA–Two-wayANNOVA–Decision tree–Concept–Analysis.	9

COURSEOUTCOMES:

AttheendofCourseStudentswillbe:
CO1:Abletobasicideasofcorrelationandlinearregression.
CO2:Abletousemathematicalvocabularytodescribetheprobabilityofeventshappening. CO3: Able to calculate a describe random variables and mathematical expectations.
CO4:Abletoapplythebasicconceptofsamplingdistributionandestimation. CO5: Able to understand the principal ideas of testing hypothesis.

TEXT BOOKS:

1. S.C.Gupta– "FundamentalsofStatistics"– HimalayaPublications– Latestedition– 2019.
2. N.D.Vohra– "BusinessStatistics"– TataMcGrawHill– 2018– Latestedition.
3. Dr.SanchetiandKapoor:BusinessMathematicsandStatistics"– SultanChand Publications.

REFERENCEBOOKS:

1. P.N.Vohra– "ComprehensiveStatisticalMethods"– S.ChandPublishers– NewDelhi– 7th edition– 2018.
2. J.Sharma– "BusinessStatistics"– VikasPublishingHousePvt.Ltd.– NewDelhi– 2014.
3. Dr.P.K.SrimaniandM.VinayakaMoorthy– "ProbabilityandStatistics"– SubhasStores.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Introduction to Data Science**					Course Code	**24BCAAL402**
	Semester	**IV**	Credits	**4**	Theory **3**	Practical **2**	TotalHours	**45T30P**

COURSEOBJECTIVES

1) TounderstandtheconceptsofDataScience.
2) Toanalyzethepreprocessingtechniquesfordataclassification.
3) Toapplystatisticalandprobabilistictechniquesfordataanalysisanddecision-making. To implement basic modeling methods for machine learning problems.
4) Toanalyzedatafromfilesandvisualizegraphicalpresentationsusing Tableau.
5)

GeneralInstructionsforTeaching-LearningProcess

1) Integratehands-oncodingexercisesusingPythonandTableauforreal-world application.
2) Develop analytical thinking using case studies and problem-solving tasks.
3) Promoteproject-basedlearning– Assignmini-projectstohelpstudentsapplydata science concepts to real datasets.
4) Encouragestudentstoexploreonlineresources– researchpapers– andindustrytrends in data science.
5) Conductregularassessmentsthroughquizzes– codingchallenges– andpractical assignments.

Module	Topics	Hours
I	**DataScienceFundamentals** Introduction – Evolution of data science – Data science process – roles in datascienceprojects–stagesinadatascienceproject–componentsofthe DataSciencelifecycle–dataanalytics–exploringandmanagingdata– cleaning and sampling for modeling and validation.	9
II	**DataCleaningand Transformation** Loading data from various file types – Accessing datasets – Data Preprocessing:Cleaningdata– removingextraneousinformation –Handling missing values – Identifying and treating outliers – Data Wrangling: Grouping– merging– combining– andconcatenatingdatasets–Reshaping data(pivoting)–Datatransformationandmapping.	9
III	**BasicStatisticsforData Analysis** Introduction to statistics–Measures of central tendency:Mean– median– mode– Introductiontoprobability–Hypothesistesting:t-test– one-sample andtwo-sampletests–Introductiontocorrelationandregression.	9
IV	**MachineLearning** Introductiontomachinelearning–Understandinglinearregression–Basics ofclassification–Modelevaluationtechniques:Accuracy– precision– recall– Introduction to logistic regression.	9
V	**DataVisualizationandInsights** Introduction to data visualization – Basic visualization techniques using Pythonlibraries(Matplotlib)–IntroductiontoTableaufordatavisualization– Visualizingtrendsandpatterns–Presentingdatainsightsthroughgraphical representations.	9

COURSEOUTCOMES

Attheendofthecourse– studentswillbeableto:
CO1:UnderstandthecoreconceptsofDataScience– includingtheprocessandlifecycle. CO2: Analyze and apply preprocessing techniques for data classification.
CO3:Applystatisticalandprobabilisticmethodsfordataanalysisanddecision-making. CO4: Implement basic machine learning models to solve real-world problems.
CO5:AnalyzedatafromfilesandcreatevisualpresentationsusingTableautoextract insights.

TextBooks

1. KhushbooShaw– Foundationof NLP:SimplifiedforBeginners– 2024– ISBN-13:979-8894985510
2. StevenS.Skiena– "TheDataScienceDesignManual"– Springer2017
3. PeterBruce– AndrewBruce– andPeterGedeck– "PracticalStatisticsforDataScientists"– 2nd edition– 2020
4. JoelGrus– "DataSciencefromScratch"– 2ndEdition– O'ReillyPublications/ShroffPublishers and Distributors Pvt. Ltd.– 2019.

ReferenceBooks

1. EmilyRobinsonandJacquelineNolis– "BuildaCareerinDataScience"– 1stEdition– Manning Publications– 2020.
2. RProgrammingforDataScience– RogerD. Peng– LeanPub– 2015

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Computer Networks**					Course Code	**24BCAAL403**
	Semester	**IV**	Credits	**4**	Theory **3**	Practical **2**	Total Hours	**45T 30P**

	COURSEOBJECTIVES
1)	To acquire the knowledge of the fundamental concepts of computer networks– network components– and communication models (OSI & TCP/IP).
2)	Learn how to transmit data and to analyze physical & data link layer operations.
3)	To Understand MAC protocols– network layer functions– and security mechanisms.
4)	Learn transport and session layer protocols for reliable communication protocols.
5)	Implement application layer protocols & explore emerging trends.
	General Instructions for Teaching-Learning Process
1)	Analyze the problem– Input/Outputrequirements– andproceduretosolveproblem before implementation.
2)	Open-sources oftware has to be used for practical implementation.
3)	Studentshouldcarryseparateobservationbookforeverylabwhichcontainsalgorithm/ flowchart and code.
4)	Refer related concepts and tutorials from web resources.

Module	Topics	Hours
I	**Introduction to Computer Networks & Network Models** Overview of Computer Networks-Network Components and Architecture- Network Models- Network Topologies-Data Transmission	6
II	**Physical Layer & Data Link Layer** Theoretical Basis for Data Communication –Transmission Media: Guided & Wireless Transmission- Communication Technologies-Data Link Layer Fundamentals-Ethernet & MAC Addressing-Data Link Layer Protocols	10
III	**Medium Access Control & Network Layer** Medium Access Control: ALOHA-CSMA/CD- CSMA/CA-Channel Allocation-NetworkLayer-RoutingProtocols-InternetControlProtocols-Network Address Translation (NAT) - Congestion Control Network Security Fundamentals: Threats and Vulnerabilities-Security Mechanisms: Firewalls- VPNs- Encryption	9
IV	**Transport Layer & Session Layer** Transport Layer Services: TCP and UDP-Internet Transport Protocols (ITP) Session Layer: Synchronization and Check pointing-Authentication and Authorization - Session Layer Protocols Dialog Control.	10
V	**Application Layer &Emerging Technologies** Application Layer Protocols: HTTP/HTTPS-FTP-SMTP-POP3-IMAP- Domain Name System & Resolution Network Applications: Web Browsing-Email Communication-File Transfer-VoIP- Streaming Emerging Technologies in Networking: Software-Defined Networking (SDN)-Network Function Virtualization(NFV)&Its Impact on Networking.	10

	Real-TimeCaseStudies:SecurityBreaches-Cloud-BasedApplications- IoT in Networking– AI-Driven Network Optimization	

COURSEOUTCOMES

At the end of the course students will be–

CO1:Tounderstandtheconceptsofcomputernetworks– their components– and different network architectures.

CO2:Learnaboutvariousdatatransmissiontechniques– and key communication protocols in physical and data layer.

CO3:Developknowledgeof MAC protocols– routing algorithms– and network security measures– including encryption and firewall mechanisms.

CO4:DescribeTCP/UDP– session management– and authentication techniques with related protocols.

CO5:Evaluateapplicationlayerprotocolsandemergingnetworkingtechnologies– and able to to justify real time case studies

TextBooks

1. Computer-Networks-AndrewS.Tanenbaum andDavidJ.Wetherall– PearsonEducation– 6th Edition– 2021.
2. DataCommunicationsandNetworking– 6thEdition– 2022– byBehrouzA.Forouzan- McGrawHill

ReferenceBooks

1. ComputerNetworking:ATop-DownApproach(8thEdition)byJamesF.KuroseandKeithW.Ross– Pearson Education.
2. DataCommunicationandComputerNetworks: ABusinessUser'sApproach(9thEdition)byCurt M.White-CengageLearning

	Program	**Bachelor Of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Software Engineering**					Course Code	**24BCAAL404**
	Semester	**IV**	Credits	**3**	Theory **3**	Practical **0**	TotalHours	**45T**

COURSEOBJECTIVES

1) Demonstrates agility in solving software and system challenges with a comprehensive set of skills appropriate to the needs of the dynamic global computing– based society.
2) Capable of diverse team and organizational leadership in computing project settings. Demonstrates
3) ethicalprinciples intheapplicationof computing– basedsolutions tosocietal and organizational problems.
4) Continuallyacquiresskillsandknowledgetosupportaprofessionalpathway– including(but not limited to) communication– analytic– and technical skills.
5) Will have experience and/or awareness of testing problems and will be able to develop asimple testing report

Module	Topics	Hours
I	**Introduction to Software Engineering**– EvolutionandimpactofSoftwareengineering–softwarelifecyclemodels–Waterfall– prototyping– Evolutionary–and Spiralmodels– Feasibilitystudy– Functional and Non–functional requirements– Requirements gathering– Requirements analysis and specification.	10
II	**Formal Modeling and verification** Thecleanroomstrategy–Functionalspecification–Cleanroomdesign–Cleanroom testing– Formal methods– Concepts– Applying mathematical notation for formal specification– Formal specification languages. Software Project Management– Themanagementspectrum–Themanagementofpeople–product–processand project–TheW5HHPrinciple–Criticalpractices.	6
III	**Software testing strategies** AStrategicApproachtoSoftwareTesting–TestStrategiesforConventionalSoftware– TestStrategiesforObject–OrientedSoftware–TestStrategiesfor WebApps–SystemTesting–SoftwareTestingFundamentals–White–BoxTesting– Black–Box Testing	6
IV	**Software Project Scheduling–** Basic concepts and principles of project scheduling–Defining task set and task network– Scheduling– Earned value analysis. Risk Management– Reactive versusproactivestrategies–Softwarerisks–riskidentification–Riskprojection– Risk refinement– Risk mitigation– monitoring and management– The RMMM plan. Maintenance and Reengineering– Software maintenance– Software supportability– Reengineering– Business process reengineering– Software reengineering– Reverseengineering–Restructuring–Forwardengineering–The economics of reengineering.	12
V	**Software Process Improvement(SPI)** Approaches to SPI– Maturity models– The SPI process– The CMMI–The People CMM– Other SPIframeworks– SPICE– Bootstrap– PSPandTSP– ISO– SPI return on investment. Software Configuration Management (SCM)– Basic concepts– SCM repository– The SCM process.	11

COURSEOUTCOMES

Attheendofthecoursestudents willbe–

CO1:Anabilitytoidentify–formulate–andsolvecomplexengineering problemsbyapplyingprinciples of engineering– science– and mathematics.

CO2: Anabilitytoapplyengineeringdesigntoproducesolutionsthatmeetspecifiedneedswith consideration.

CO3:Anabilitytorecognizewhichparticulartestingtoolsshouldusewhiledevelopingasoftware.

CO4:Anabilitytorecognizeethicalandprofessionalresponsibilitiesinengineeringsituationsandmake informed judgments.

CO5: An ability to function effectively on a team whose members together provide leadership– create a collaborative and inclusive environment– establish goals– plan tasks– and meet objectives.

TextBooks

1. FundamentalsofSoftwareEngineeringbyRajibMall– PHI– 3rdEdition– 2009.
2. RogerS.Pressman–"*SoftwareEngineering*– APractitioner'sApproach"– AlternateEdition–7th Edition– McGraw Hill 2010.

ReferenceBooks

1. SoftwareEngineering– byIanSommerville– PearsonEducationInc.– NewDelhi– (2009).
2. SoftwareEngineering– APractitioner"sApproach"– byRogerS.Pressman– McGraw– Hill.(2005).
3. PankajJalote"AnIntegratedApproachtoSoftwareEngineering"– NarosaPublishingHousePvtLtd– Darya Ganj– New Delhi 110002

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Professional Communication and Ethics**					Course Code	**24BCAAL405**
	Semester	**IV**	Credits	**2**	Theory **2**	Practical **0**	TotalHours	**30T**

	COURSEOBJECTIVES
1)	ToknowaboutfundamentalsofcommunicativeEnglishandcommunicationskillsin general. gTodevelopnon-verbalcommunicationandactivelisteningskills.
2)	Toenhancespeaking– presentation– resumewriting– andinterviewskills.
3)	Toimprovegroupcommunication– readingcomprehension– andprofessionalwriting.To make the
4)	students understand the importance of ethics.
5)	

	GeneralInstructionsforTeaching-LearningProcess
1)	Encourageinteractivelearningthroughdiscussions– role-plays– andcasestudiesto enhance communication skills.
2)	Focusonpracticalexerciseslikeresumewriting– presentationdelivery– andemail drafting for real-world applications.
3)	Promoteactivelisteningandspeakingbyinvolvingstudentsinactivities thatimprove clarity– fluency– and confidence.
4)	Integrateethicalscenariosandcasestudiestohelpstudentsunderstandandapply professional ethics in various situations.
5)	Incorporategroupactivitiesandpeerevaluationstofosterteamwork– constructive feedback– and collaborative learning.

Module	Topics	Hours
I	**Introduction to Technical Communication** Introduction – importance of technical communication – general and technical communication – objectives and characteristics of technical communication – process of communication – levels of communication – flowofcommunication– visualaidsintechnicalcommunication–Barriersto Communication:Introduction–classificationofbarriers.	6
II	**Non-Verbal Communication and Effective Listening** Non-Verbal Communication: Introduction – Kinesics – Proxemics – Chronemics – Correlating verbal and non-verbal communication – Active Listening:Introduction– Reasonsforpoorlistening–Traitsofgoodlisteners – Barriers to effective listening – Listening for general content and specific information.	6
III	**Effective Speaking– Presentation Skills– Resumes– and Interview Preparation** EffectiveSpeaking:Introduction–Achievingconfidence– clarity– andfluency – Vocalcues–FormalPresentations:Planningandstructuringpresentations – Guidelines for effective delivery – Overcoming nervousness – Visual aids inpresentations–Interviews:Introduction–objectivesofinterviews–types ofinterviews–jobinterviews–Resumes:Resume–biodataandcurriculum vitae – resume design and structure.	6
IV	**Group Dynamics and Professional Writing** Group Communication: Forms of group communication – Use of body language in group communication – Discussions and group discussions – ReadingComprehension:Improvingcomprehensionskills–FormalLetters– EmailsandResearch:Introductiontoletterwriting–coverletters– professionalemailwriting–research writing	6

V	**Ethics in Professional Life** BasicConceptsofEthics:Introductiontopersonalandprofessionalethics – Ethical dilemmas – Emotional intelligence – Responsibilities and Rights of Professionals – Global Issues: Environmental ethics– research ethics– intellectual property rights – Introduction to ethical codes in the profession.	6

COURSEOUTCOMES

Attheendofthecoursestudents willbe–
CO1:ExplainthefundamentalsofcommunicativeEnglishandessentialcommunicationskills. CO2:
Demonstrate non-verbal communication and active listening skills.
CO3: Develop confidence in speaking– presentations– and interviews.
CO4:Applygroupcommunicationandprofessionalwritingtechniques.
CO5:Analyzeethicalissues– responsibilities– andglobalprofessionalethics.

TextBooks

1. MeenakshiRamanandSangeetaSharma– "TechnicalCommunicationPrinciplesandPractices"– 3rd Edition– Oxford University Press– 2015.
2. R.Subramanian– "ProfessionalEthics"– 2ndEdition– OxfordUniversityPress– 2017.

ReferenceBooks

1. M.AshrafRizivi– "EffectiveTechnicalCommunication"– 2ndEdition– TataMcGrawHill– 2017.2. Mike W Martin and Ronald Schinzinger– "Ethics in Engineering"– 4th Edition– Tata McGraw Hill– 2017.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Intellectual Property Rights-IPR**					Course Code	**24BCAAL406**
	Semester	**IV**	Credits	**1**	Theory **1**	Practical **0**	TotalHours	**15T**

	COURSEOBJECTIVES
1)	Torecognizetheimportanceof IPandtoeducatethepupilsonbasicconceptsof Intellectual Property Rights.
2)	Toidentifythesignificanceof practiceandprocedureof Patents.
3)	Tomakethestudentstounderstandthestatutoryprovisionsof differentformsof IPRs in simple forms.
4)	TolearntheprocedureofobtainingPatents– Copyrights– TradeMarks&Industrial Design To
5)	enable the students to keep their IP rights alive.
	GeneralInstructionsforTeaching–LearningProcess
1)	AssignstudentstodevelopanIPportfolioorcreateamock–upof anIPlitigation case.
2)	Discussongoingdebatesaboutdigitalrightsmanagement– patentingofgenetic materials– and software patents.
3)	Practicalsessionsforfilingpatents– registeringtrademarks– orreviewingIPcontracts. Organize group projects where students collaborate to create and protect intellectual property.
4)	Havestudentsresearchandpresentonspecificaspectsof IP law
5)	

Module	Topics	Hours
I	**Introduction to IPR** INTRODUCTIONTOIPR:Meaningofproperty–Origin–Nature–Meaning of Intellectual Property Rights – Introduction to TRIPS andWTO – Kinds of Intellectual property rights – Copy Right – Patent – Trade Mark – Trade Secretandtradedress–Design–LayoutDesign–GeographicalIndication – Plant Varieties and Traditional Knowledge.	3
II	**Patent Rights And copyrights** PATENTRIGHTSANDCOPYRIGHTS:Origin–MeaningofPatent–Types – Inventionswhicharenotpatentable–RegistrationProcedure–Rightsand DutiesofPatentee–Assignmentandlicense–RestorationoflapsedPatents – Surrender and Revocation of Patents – Infringement – Remedies & Penalties. – COPY RIGHT – Origin– Definition &Types of Copy Right– Registration procedure– Assignment & license – Terms of Copy Right – Piracy–Infringement–Remedies– Copyrightswithspecialreferenceto software.	4
III	**Trade Marks and Types** TRADEMARKS—Origin–Meaning&NatureofTradeMarks–Types– RegistrationofTradeMarks–Infringement&Remedies–Offencesrelating toTradeMarks– PassingOff–Penalties.–DomainNamesoncyberspace.	3
IV	**Design** DESIGN– Meaning – Definition – Object – Registration of Design – CancellationofRegistration–Internationalconventionondesign–functions of Design – Semiconductor Integrated circuits and layout design Act–2008.	3

V	**Basic Tenants of Information Technology** Basic tenants of information technology act – IT Act – Introduction E–Commerceandlegalprovisions–E–GovernanceandlegalprovisionsDigital signature and Electronic Signature – Cybercrimes–	2

COURSEOUTCOMES

Attheendofthecoursestudents willbe–

CO1:Distinguishand ExplainvariousformsofIPRs.

CO2:Identifycriteria'stofitone'sownintellectualworkinparticularformofIPRs. CO3:Apply statutory provisions to protect particular form of IPRs.

CO4: Analyses rights and responsibilities of holder of Patent– Copyright– Trademark– and Industrial Designate.

CO5:IdentifyproceduretoprotectdifferentformsofIPRsnationalandinternationallevel. CO6:Develop skill of making search using modern tools and technics.

TextBooks

1. IntellectualPropertyRightsandtheLaw– GogiaLawAgency– byDr.G.B. Reddy
2. IntellectualPropertyRights:PublishedbyDr.NKAcharya– 8thEdison– PublicationYear:2021

ReferenceBooks

1. IntellectualPropertyRights: Dr.KhushdeepDharniandDr.NeerajPandey– Publication Year: 2014
2. IntellectualPropertyRights –Volume1byProf.Dr.JyotiRattancoverstopicssuchas copyrightInfringement– broadcasting rights– and civil remedies.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**User Interface & User experience design**					Course Code	**24BCAALE11**
	Semester	**III**	Credits	**3**	Tutorial **2**	Practical **2**	TotalHours	**30T30P**

Tutorial	
1.	Thebasicsof UIandUX -ExploreUI/UXprinciplesandreal-worldexamplesand Figmatool introduction.
2.	CompetitorAnalysis–Analyzeandreviewexistingapps/websitesforusability. Adobetoolintroduction&usage.
3.	HowtodotheUserResearch&PersonaCreation.
4.	SketchingWireframes(Paper-based)–Sketchlow-fidelitywireframesforamobile app
5.	DigitalWireframing(Figma/XD)–Convertpaper wireframesintodigitalversions. Balsamiqtoolintroduction& usage.
6.	Typography&ColorTheory–ExperimentwithfontsandcolorsinUIusingvarious fonts&colors.
7.	CreatingButtons&Forms–Designinteractive buttonsandform elements.
8.	CardLayout&GridSystem–StructureUIusinggridsforbetteralignment
9.	Mobilevs.DesktopUIDesign –Designthesameinterfacefordifferentdevices.
10.	UIConsistency&Spacing–Improvespacingandvisualbalance.
11.	CreatingClickablePrototypes –AddinteractivitytodesignsinFigma/XD.
12.	Microinteractions&Animations –Implementsmallanimations(e.g.– buttonhover).
13.	NavigationDesign(Menus&Tabs)–Designuser-friendlynavigationsystems.
14.	CreatingaLogin&SignupFlow–Designandprototypeauthenticationscreens.
15.	UsabilityTestingBasics–Testprototypeswithpeersandgatherfeedback.
16.	RedesignaBadUI –Takeanexistingbaddesignandimproveit.
17.	E-commerceAppUI–Designasimpleproductlistingandcheckoutflow.
18.	SocialMediaAppUI–Createprofilepagesandfeed layouts.
19.	PortfolioWebsiteUI–Designapersonalportfolio websiteinFigma.
20.	SmartHomeAppUI–DesigncontrolsforIoThome automation.
21.	High-FidelityPrototyping–EnhanceUIwithimages– icons– andrealdata.

22.	AdvancedAnimations(Figma/XD)–Createanimatedtransitionsbetweenscreens.
23.	UserFeedback–Comparetwoversionsof aUIandcollectfeedback.
24.	UsabilityTestingwithRealUsers–Inviteuserstointeractwithyour design.
25.	Accessibility&InclusiveDesign–OptimizeUIforvisuallyimpairedusers.
26.	DesignSystem&UIKits–Createreusablecomponentsfor consistency
27.	ExportingAssetsforDevelopers –Learnhowtohandoffdesignstodevelopers.
28.	IntroductiontoUXWriting –WritebettermicrocopyforUI.
29.	FinalUI/UXProject-Howtodoafullproject.
30.	Portfolio&ResumeBuilding–Showcaseyour UI/UXprojectsonline
	Lab Programs
1.	Identify3goodand3badUI/UXdesignsfromexisting websitesormobileapps
2.	UIDesignPrinciples–GestaltPrinciplesandapplythemtoasimpledesign
3.	Createamoodboardforane-commerce website.
4.	Comparedifferentfontsandcreateatypographyhierarchyforanews website.
5.	Sketcha**low-fidelitywireframe** of amobileapploginscreen.
6.	Sketcha wireframefora**fooddeliveryapp**homepage.
7.	Designamid-fidelitywireframeforablogwebsitehomepageAdobeXDor Balsamiq.
8.	Designasimplelandingpageforatravel websiteusingFigma.
9.	ConvertthewireframeintoaclickableprototypeusingFigma&addhovereffects– transitions– andinteractionstoimproveusability.
10.	DesignanavigationbarforadashboardwithproperUX flow.
11.	Designamobileanddesktopversionofthesamepageandcompare.
12.	**DarkModeUIDesign**–Designadarkmodeversionofapopularapp interface.
13.	Conductaheuristicevaluationof awebsiteandsuggest improvements.
14.	Performasimpleusabilitytestbyaskinguserstocompleteataskonagivenapp anddocumenttheirfeedback.

15.	CreateasimplehomepagewithHTML&CSS.
16.	Responsive Navigation Bar – Develop a mobile-friendlynavbar using Flexbox/Grid.
17.	Login&RegistrationPage–Designauser-friendlyloginandregistrationform.
18.	FormValidationUI–Addreal-timeformvalidationmessagesusingJavaScript.
20.	FinalUI/UXMini-Project–CreateafullUI/UXdesignandimplementationfora smallapp(E-commerce– Education– Healthcare– etc.).

E–Learning websites

1. https://www.figma.com/resource-library/design-basics/
2. https://www.nngroup.com/
3. https://m3.material.io/
4. https://www.canva.com/designschool/

References

1. https://www.behance.net/
2. https://dribbble.com/

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Web Content Management**					Course Code	**24BCAALE12**
	Semester	**III**	Credits	**3**	Theory **3**	Practical **0**	Total Hours	**45T**

COURSEOBJECTIVES

1) To acquire the knowledge of the fundamental concepts &principles of WCM techniques.
2) To Learn WCM Types and Formats
3) To Learn Norms and Guidelines of Content Development.
4) To Learn to Create Digital Graphics.
5) To Learn to Handle Audio Production and Editing.

GeneralInstructionsforTeaching-LearningProcess

1) Promoteactiveparticipationthroughhands-onexercisesandreal-worldcasestudies. Use industry-
2) standard tools and software for content management– graphic design– and audio editing & Assign project-based tasks to apply theoretical knowledge in real-worldscenarios.
3) Providecontinuousfeedbackandencouragecollaborationthroughpeerreviewsand group work.
4) Integratemultimediaresourcesandguestlecturestoexposestudentstocurrent trends and industry practices.

Module	Topics	Hours
I	**WCMBasics** Definition-How does a WCMS work-parts of typical web content Management system-Uses of a WCMS-Capabilities & Features- MeaningofWebContent-ContentManagementSystem-TypesofWeb Content Management System-Traditional CMS vs WCMS	10
II	**WCMTypesandFormats** MIMEtypes(IANAmediatypes)-Structureof aMIMEtype-MIME(Multi Purpose Internet Mail Extension)/ Content Type-Content Formats	6
III	**NormsandGuidelinesofContentDevelopment** NormsofContentDevelopment-Guidelinesof ContentDevelopment	5
IV	**CreatingDigitalGraphics** Definition-DigitalGraphicsApplications-Purpose&designofthegraphic -FileTypes-TypesofDigitalGraphics-Basicelementsofdigitalgraphics -CreatingDGinCMS(ContentManagement System	12
V	**AudioProductionandEditing** Definition-AudioProduction-AdvancedAudioRecording– Editing-Studio Production-MusicComposition-AudioProduction&Editing-Audioediting softwares	12

COURSEOUTCOMES

Attheendofthecoursestudentswillbeableto–
CO1:UnderstandandapplythefundamentalsofWebContentManagement (WCM)techniques and principles.
CO2:IdentifyandutilizevariousWCMtypesandcontentformats effectively.
CO3:Applyindustrynormsandguidelinesforcontentdevelopmentandoptimization. CO4: Create and edit digital graphics optimized for web use.
CO5:Produceandedit high-qualityaudiocontentfordigitalplatforms.

TextBooks
1) WebContentManagement– DeaneBarker– O'ReillyMedia– Inc. 2) ASimpleWebContentManagementSystem– SatyaJoshi– LambertAcademicPublishing 3) Choosing aWebContentManagementSystem:CMSTips– Myths– MistakesandBest Practices Kindle Edition
ReferenceBook
1) WebContentManagement:ACollaborativeApproach1stEdition– Addison-Wesley Professional
E-learningWebsites
1) https://www.scnsoft.com/education/learning-content-management-system 2) https://www.edx.org/learn/web-content-management-system 3) https://senseilms.com/elearning-cms/ 4) https://www.ctuniversity.in/quick-link/learning-management-system-e-resources
WebResourceMaterials
1) https://www.researchgate.net/publication/220672404_Understanding_Web_content_management_systems_evolution_lifecycle_and_market 2) https://irojournals.com/rrrj/articles/download/2/1/12 3) https://www.ijcstjournal.org/volume-7/issue-2/IJCST-V7I2P22.pdf 4) https://ieeexplore.ieee.org/document/9509991

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**E-Commerce Application Development**					Course Code	**24BCAALE13**
	Semester	**III**	Credits	**3**	Theory **3**	Practical **0**	TotalHours	**45T**

	COURSEOBJECTIVES
1) 2) 3) 4) 5)	TounderstandthefundamentalsandtechnologiesbehindE-Commerce ToexplorewebdevelopmentframeworksforbuildingE-Commerceapplications To integrate payment gateways and ensure security in E-Commerce system TodevelopafunctionalE-Commercewebapplication Toanalyzecasestudiesof successfulE-Commerceplatforms
	General Instructions for Teaching-Learning Process
1) 2) 3) 4) 5)	Experiential Learning through Real-World Case Studies & Industry Trend Interactive&PracticalSessionswithWebTechnologiesandLiveDemonstrations Project-Based Learning for Backend Development & Payment Integration Simulation & Gamification for Cybersecurity and Legal Aspects CollaborativeLearningviaExpertTalks– Workshops– andIndustryVisits.

Module	Topics	Hours
I	**Introduction to E-Commerce** Definition – Scope– Evolution of E-Commerce– Types of E-Commerce: B2B– B2C– C2C– C2B – M-Commerce – Business Models – Revenue Streams– Benefits– LimitationsofE-Commerce–OverviewofDigital Payment Systems (UPI– Credit/Debit Cards– Net Banking) – Introduction to E-Commerce Platforms– Shopify– WooCommerce– Magento	9
II	**Web Technologies for E-Commerce** Basics of HTML5 – CSS3 – JavaScript for UI Design – Responsive Web Design – User Experience (UX) – Introduction to Frontend Frameworks (React– Angular– Vue.js) – Basics of Web Hosting – Domain Name Registration – SSL Certificates	9
III	**Back end & Payment Integration** Introduction to Back end Development –PHP–Python–Node.js Integration of Databases – MySQL – MongoDB Firebase Server-Side – REST API Development for E-Commerce Apps –User Authentication Role-Based Access Control Shopping Cart Implementation – Checkout Process– PaymentGatewayIntegration(Razorpay– PayPal– Stripe)–Order Management – Shipping – Invoice Generation.	10
IV	**Security & Legal Aspectsin E-Commerce** CybersecurityThreatsinE-Commerce(Phishing– SQLInjection–XSS Attacks) – Secure Transactions with HTTPS – SSL – Data Encryption – CustomerDataProtection–Privacy(GDPR– ITAct)–FraudPrevention– TechniquesinOnlinePayments–LegalFrameworkofE-CommerceinIndia Consumer Rights and Policies for Online Transactions.	10
V	**Data-DrivenDecisionMakinginE-Commerce**	7

	AI and Chatbots in E-Commerce(PersonalizedShopping)–Secure Transactions – Customer Behavior Analysis E-Cloud Computing for Scalable E-Commerce ApplicationsCaseStudies–Amazon–Flipkart–Myntra–Swiggy–Meesho.	

COURSEOUTCOMES

Attheendofthecoursestudents willbe–

CO1:ExplainE-Commerceconcepts– businessmodels– anddigitalpaymentsystems.

CO2:Design responsive E-Commerce websites using HTML– CSS– JavaScript– and frontend

CO3:Develop backend applications with PHP– Python– or Node.js and integrate databases.

CO4:Implementpaymentgateways– shoppingcarts– securityprotocolslikeSSLandencryption. CO5:Analyze cybersecurity risks– legal regulations– and emerging trends like AI– Blockchain

TextBooks

1. E-Commerce:Business– Technology– Society–KennethC.Laudon&CarolGuercioTraver 17th Edition: 2023
2. PEARSON.COME-Commerce2023–DaveChaffey– PublicationYear:2023

ReferenceBooks

1. WebTechnologies:TCP/IPArchitectureandJavaProgramming– AchyutS.Godbole& Atul McGraw-Hill Education (India)– 2nd Edition– 2010.
2. EnterpriseCyberSecurity:SecondEdition– GurpreetDhillon– independentlypublished– 2nd Edition– 2022.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Accounting and Financial Management**					Course Code	**24BCAALE14**
	Semester	**III**	Credits	**3**	Theory **3**	Practical **0**	Total Hours	**45T**

	COURSEOBJECTIVES:	
1)	Tounderstandingofaccounting'shistory– principles– systems– standards– anditsrole in business decision-making.	
2)	Tostudyfinancialaccountingprocess– includingtransactions– debit/creditrules– journal entries– ledger preparation– subsidiary books– and bank reconciliation.	
3)	Tounderstandknowledgeofaccountingproceduresforbillsofexchange– their types– and financial impact.	
4)	Tolearnstudentsthepreparationoffinalaccounts– includingmanufacturing– trading– profit and loss accounts– and balance sheets for sole traders and partnership firms. To familiarize	
5)	students with Tally ERP 9– including company creation– account management– andinventorysettings.	
	Topics to be covered	**Hours**
I	**Introduction to Accounting and Accounting Concepts and conventions**	9
	Introduction: History and Development of Accounting– Meaning ObjectivesandfunctionsofAccounting–Book–keepingV/sAccounting– Users of accounting data–systems of book – keeping and accounting– branches of accounting– advantages and limitations of accounting. AccountingConceptsandconventions:Meaningneedandclassification – Accounting standards– meaning –need and classification of Indian accounting standards. Accounting principles V/s Accounting standards.	
II	**Financial Accounting Process and Journalisation and Ledger position Preparation of different subsidiary books**	9
	FinancialAccountingProcess:Classificationofaccountingtransactionand accounts – rules of debit and credit as per Double Entry System. Journalisation and Ledger position Preparation of different subsidiary books:PurchaseDayBookSalesDayBook –PurchaseReturnsDay Books –Sales Returns DayBook –CashBook. Bank Reconciliation Statement: Meaning –Need – Definition –preparation of BRS.	
III	**Accounting for bill of exchange and Types of Bills. Accounts Procedure**	9
	Accountingforbillof exchange: Meaning –Need–Definition–Particeto Bill of Exchange TypesofBills.AccountsProcedure:HonouroftheBill–Dishonourofthe Bill – Endorsement –Discounting –Renewal –Bills for collection – Retirement of the Bill –Accommodation Bills –BillReceivable Book and PayableBook.PreparationofTrialBalance:Rectificationoferrorsand journal Proper.	
IV	**Preparation of Final accounts**	9
	PreparationofFinalaccounts:Meaning–needandclassification– Preparation of Manufacturing–Trading–ProfitandlossaccountandBalance-Sheetof sale -traders and partnership firms.	
V	**Accounting Package like Tally**	

	Introduction of TallyERP9 –Info Manu–Creation of a Company– Gateway of Tally Account information :Ledgers and Groups creation Inventory information: Determination of stock groups –Stock items and stock units	9

COURSEOUTCOMES:

Attheendofthecoursestudents willbe–

CO1: Able to distinguish between bookkeeping and accounting– understand accounting systems

CO2:Toapplydebit/creditrulesandpreparejournalentries– ledgers– subsidiarybooks– andbank reconciliationstatements.

CO3:Proficientinrecordingbillsofexchangetransactionsandhandlingassociatedfinancial records and procedures.

CO4:Topreparefinalaccountsandbalancesheetsforsoletradersandpartnershipfirms.

CO5:TouseTallyERP 9tocreatecompanies– manageledgers– andconfigureinventorydetails.

TextBooks:

1. S.Ramesh– B.S.Chandrashekar– aTextBookofAccountancy.

ReferenceBooks:

1. V.A.PatilandJ.S.Korihalli– Book-KeepingandAccounting– (R.ChandandCo. Delhi).
2. R.S.Singhal– PrinciplesofAccountancy– NageenPrakashpvt.Ltd– Meerut.
3. B.S.Raman– Accountancy– (UnitedPublishers– Mangalore)

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**				Program Code	**24BCABAL**	
	Course	**Data Visualization Using Tableau**				Course Code	**24BCAALE15**	
	Semester	**III**	Credits	**3**	Theory **2** / Practical **2**	Total Hours	**30T30P**	

	COURSEOBJECTIVES
1)	Understand Excelbasics– formulas– dataanalysis– visualization– automation– and best practicesforefficientdatamanagement.
2)	UnderstandacomprehensiveoverviewofDataScience– includingtheuseoftoolslike Tableaufordatavisualization– coveringdataterminology– datahandling– cleaning– and analysistechniques.
3)	Understandingcreatingvisualizations– applyingcalculations– andusingfunctionsin Tableauforadvanceddataanalysis.
4)	Learnfiltering– grouping– sorting– andparameter-basedtechniquesinTableaufor enhanceddatavisualizationandanalysis.
5)	Learntocreatevariouscharttypesanddesigninteractivedashboardsin Tableau– incorporatingfilters– objects– formatting– andforecastingforeffectivedatavisualization.

	GeneralInstructionsforTeaching-LearningProcess
1)	Encouragehands-onpractice– step-by-stepguidance– interactivelearning– practical assignments– andregularassessmentswhileprovidingresourcesandcontinuous feedbackforeffectiveExcellearning.
2)	Usereal-worldexamples– hands-onpracticewithtoolslikeTableau– andinteractive discussionstoteachdatascienceconcepts– datacleaning– andanalysistechniques.
3)	Focusonhands-onpracticewithTableau– providingstep-by-stepguidanceoncreating visualizations– applyingcalculations– andusingfunctionsforadvanceddataanalysis.
4)	Teachfiltering– grouping– sorting– andparameter-basedtechniquesinTableauthrough hands-onexercises– providingclearexamples andreal-timeguidanceforeffectivedata visualizationandanalysis.
5)	Guidestudentsthroughcreatingvariouscharttypesandinteractivedashboardsin Tableau– emphasizingtheuseoffilters– objects– formatting– andforecastingfor effectivedata visualization.

Module	Topics	Hours
I	**Introduction to Excel** Introduction to Excel basics: Workbook– Worksheet– Cell– and Range – UnderstandingtheExcelinterfaceandnavigation–Workingwithdatatypes and formatting cells – Using formulas and functions (SUM– AVERAGE– IF– VLOOKUP) – Data visualization with charts and conditional formatting – Analyzing data using PivotTables and PivotCharts – Linking and consolidating data across multiple sheets/workbooks – Introduction to MacrosandVBAforautomation–UsingPowerQueryandPowerPivotfor datatransformation–Excelbestpracticesfororganization– errorprevention– and optimization.	6
II	**Introduction to Data Visualization** What is Data Science – Diferrent types of tools in data science – What is Tableauanditsimportanceindatavisualization?Tableau–Dataterminology DifferencebetweenGoogleDataStudiovsTableauNavigation–Startpage inTableauDesignflow–FilesysteminTableauDatatypes–Howtochange datatypeinTableau?Working withdatasources:Connecttoadata source Import Excel file in Tableau Data cleaning in Tableau Tableau – Join databasesJoiningdatafileswithinconsistentlabelsDatablending	6
	ReplacingdatasourceSplitthetexttocolumnsDisplayingdatainworksheet Adding– renaming– and duplicating worksheets	

III	**Data Visualization Techniques** Create visualizations in Tableau – Change the order of elements in a visualization Modify summary calculations in Tableau Introduction to TableaucalculationsandoperatorsUsingtheIFfunctioninTableauApplying aggregatefunctionsinTableau–CreatingcalculatedfieldsinTableauUsing logicalfunctions inTableau Understandingand applyingtheCASEfunction inTableauWorkingwithhighlighttablesinTableauImplementingquicktable calculationsinTableau–IntroductiontoLevelofDetail(LOD)calculations in Tableau.	6
IV	**Sort and Filter with Tableau** FilteringinvisualizationinTableau–UsingquickfiltersinTableau–Applying context filters in Tableau – Creating conditional filters in Tableau – Understanding slicing filters in Tableau – Grouping elements in Tableau visualization – Creating and working with hierarchies in Tableau - Introduction to sets and combined sets in Tableau – Working with parameters in Tableau – Using bins for grouping data in Tableau – Manual sortingofvisualizationsinTableau– SortingbydatasourceorderinTableau –SortingbyfieldinTableauvisualizations.	6
V	**Different Charts and Working with Dashboards inTableau** Line graph – Dual lines chart – Bar chart – Stacked bar chart – Histogram Cumulative histogram – Scatter plot – Bubble chart – Pie chart – Crosstab Totalinacross tabbycolumn–Boxplot –Bulletgraph–Areachart –Heat map– Basicmap– Geographicalplot–Lollipopchart –Circleviews– Dual combinationchart– Treemap– FunnelchartinTableau–Traditionalfunnel chart – Waterfall chart – Gantt chart. Introduction dash board design – create a dashboard – text object on dashboard– imageobjectondashboard–Tableau–objectsondashboard – filters in dashboard – device preview – format dashboard layout–forecast.	6

COURSEOUTCOMES

Attheendofthecoursestudents willbe–

CO1:Proficient in using Excel for data management– formulas– and visualization.

CO2:SkilledinapplyingTableaufordatavisualization– analysis– andcalculations. CO3:Capable of creating and interpreting advanced visualizations in Tableau.

CO4:ExperiencedinusingTableau'sfiltering– grouping– andsortingtechniquesfordataanalysis.

CO5: AbletodesigninteractiveTableaudashboardswithfilters– objects– andforecastingfor enhanced data insights.

TextBooks

1. DanMurray– "TableauYourData"– 2nd Edition– Wileypublication– 2016.
2. SteveWexler– JeffreyShaffer– AndyCotgreave– "TheBigBookDashboards:VisualizingYour Data Using Real-World Business Scenarios"– 1st Edition– Wiley publication"– 2017.

ReferenceBooks

1. StephenFew– "TheDataLoom:WeavingUnderstandingbyThinkingCriticallyand Scientifically with Data" – Analytics Press– 2019.
2. JoshuaN.Milligan– "LearningTableau"– 3rd Edition– PacktPubLtd.– 2015.
3. https://www.geeksforgeeks.org/tableau–tutorial/
4. https://www.tableau.com/learn/training.
5. https://www.guru99.com/tableau–tutorial.html
6. https://www.udemy.com/courses/search/?src=ukw&q=tableau

	Program	**Bachelor Of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Linux Administration**					Course Code	**24BCAALE21**
	Semester	**IV**	Credits	**3**	Tutorial **2**	Practical **2**	Total Hours	**30T30P**

COURSEOBJECTIVES

1) ThiscourseintroducesbasiccommandsinLINUXandhelpsstudentsin familiarizing the concepts of LINUX operating system.
2) ThiscourseisdesignedtointroducethestudentstodeveloptheskillsneededfortheRedHat EnterpriseLinux/Ubuntu24.10 Linux latest.
3) Thiscourseintroduceskeycommandlineconceptsandenterprise-leveltools– laying the foundation for the rapid deployment of Red Hat Enterprise Linux/Ubuntu Linux-24.10.
4) ThiscourseprovidesanintroductiontoLinuxsystemAdministrationtutorial based. Ithelpsstudentsgainknowledgeandskillsrequiredfortheroleof Linuxsystem administrator in industry.
5)

GeneralInstructionsforTeaching-LearningProcess

1) AppropriateModels– PowerPointpresentation– Charts– Videos– shallbeusedto enhance visualization before hands on practice.
2) Makeuseof Linuxcommandsformanagingprogramsinstallation. Use Linux Applications to solve problems.
3) Simpleexamplesoneachtopic.
4) UseofVideo/Animationtoexplainfunctioningofvariousconcepts.
5)

Module	Topics		Hours
I	**SystemAdministrationOverview**		
	Session 1	Introduction – Installation – History of Linux-Linux Architecture– ShellProgramming– Folderhierarchy.	1
	Session 2	Duties of the SystemAdministrator –Super users and the Root Login	1
	Session 3	SharingSuperuserPrivilegeswithOthersBoot Process – Kernel in detail.	1
	Session 4	System Initialization – GRUB(Modify the system boot loader) – GUICLI(Access a shell prompt) and issuecommandswithcorrectsyntax-createandedit text files– delete– copy– and move files and directories.	1
	Session5	IntroductiontoBashShell–BasicCommands– Editors–ManPages–Bootsystemsintodifferent targets manually & automatically.	1
	Linux Security and File System		
	Session 6	FilePermissions–DirectoryPermissions–Octal- Representation– Changing Permissions	1
	Session 7	SettingDefaultPermissions–AccessControl Lists(ACLs)– Thegetfaclandsetfaccommands	1

II	Session 8	Special Permision(SUID– SGID– Stickybit)– File systemTypes-ConventionalDirectory–Structure Mounting a File System	1
	Session 9	The /etc/fstab File-Special Files (Device Files) – Inodes Hard File	1
	Session 10	Links–SoftFileLinks–CreatingNewFile Systems with mkfs	1
III	**Linux User Management**		
	Session 11	SettingPolicies–UserFileManagement–The /etc/passwd file – The /etc/shadow fileThe /etc/groupfile	1
	Session 12	The/etc/gshadowfile–AddingUsers-Modifying User Accounts – Deleting User Accounts	1
	Session 13	Working with Groups – Setting User Environments – Characteristics of Processes– Parent-Child Relationship	1
	Session 14	Examining Running Processes – Background Processes Controlling Processes	1
	Session 15	Signaling Processes – Killing Processes – AutomatingProcessescronandcrontab–atand batch	1
IV	**Linux Kernel and Linux Volume Manager**		
	Session 16	LinuxKernelComponents–TypesofKernels	1
	Session 17	Configuration Options – Recompiling the Kernel	1
	Session 18	Kernel–Partitions–LogicalVolumeManager	1
	Session 19	LVM–FileSystemOverview	1
	Session 20	ExtendLVMPartitions–LVMSnapshot	1
	Advanced concepts in LVM		2
V	Session 21	SwapPartitionConsiderations	
	Session 22	OtherPartitionConsiderations	2
	Session 23	LVMReplace–LVMRemoveLVMRename	1
	Session 24	AmandabackupforLVM	3
	Session 25	ControllingLVMinCLImode	2
***ThePracticalsessiondurationis2hourpersession*.**			
PRACTICALEXERCISES			

	Practical Session	Topicandprogram-1	KeyLearning Activitiesand program-2
	Session 1	IntroductiontoLinuxadministration	Installation– Linux UI Environment Introduction
	Session 2	Terminal– All Basic commands– Bash commands Shell Programming: shell script exercise based on following: Interactive shell script Positional parameters ArithmeticIf-then-fi– if-then-else-fi nestedif-elseLogicaloperatorsElse+ifequalselif case structureWhile– for loopMeta characters	Use of basic Unix Shell Commands: ls– mkdir– rmdir– cd– cat– banner– touch– file– wc– sort– cut– grep– dd– dfspace– du– ulimit
	Session 3	ToInstallUbuntuLinuxandLINUXCommands(File Handling utilities Text processing utilities Network utilities Disk utilities Backup utilities and Filters)	Commands relatedtoinode– I/O redirection– piping– process control commands– mails.
	Session 4	WriteaShellScriptthatacceptsafilename– starting andendinglinenumbersasargumentsanddisplays all lines between the given line numbers.	Write a shell scripttolistallof the directoryfiles in a directory
	Session 5	Write a shell script that deletes all lines containing the specified word in one or more files supplied as arguments to it.	Writeashell scripttofind factorialof a givennumber.
	Session 6	Write a shell script that displays a list of all files in the current directory to which the user has read– write and execute permissions.	write an awk script to count numberoflines inafilethat
			doesnotcontain vowels
	Session 7	Write a shell script that receives any number of file names as arguments checks if every argument supplied is a file or directory and reports accordingly.whenevertheargumentisafileit reportsnoof linespresentinit	write an awk scripttofindthe noofcharacters – wordsandlines inafile

	Session 8	Write a shell script that accepts a list of file names asitsarguments– countsandreportstheoccurrence ofeachwordthatispresentinthefirstargumentfile on other argument files.	Implement in c language the following Unix commands using system callsa)catb)ls c)mv
	Session 9	Write a C program that takes one or more file/directory names as command line input and reportsfollowinginformationa)FileTypeb)Number Of Links c) Time of lastAccess d) Read – write and execute permissions a)WriteaCprogramtocreatechildprocessand allow parent process to display "parent" and the child to display "child" on the screen	Write a C programtolist every file in directory– its inode number and file name
	Session 10	WriteaCprogramtoillustratehowanorphanprocess is created	Write a C program to createzombie process
	Session 11	WriteaCprogramthatillustratecommunication betweentwounrelatedprocessusingnamedpipes	System administration tools
	Session 12	Write a C program that receives a message frommessage queue and display them	UnixandLinus distribution names and companies
	Session 13	Write a C program to allow cooperating process to lock a resource for exclusive use (using semaphore)	LinuxOperating System installation guidelines
	Session 14	WriteaCprogramthatillustratethesuspendingand resuming process using signal	Write a C program that implements producer-Consumer systemwithtwo process using semaphore
	Session 15	Writeclientserverprogramsusingcforinteraction betweenserverandclientprocessusingUnix Domain sockets	WriteaC program that illustratestwo
			processes communicating using Shared memory
COURSEOUTCOMES			

CO1:UnderstandbasicsofvariousOSrelatedconcepts– fromsystemadministrator'spointof view
CO2:Acquiringhandlingabilityabovefiles– directories– kernel– inodes– APIs– systemcalls– processes– signals– etc.
CO3:Developapplicationswhereseveralprocessesneedtocommunicatewitheach otherto complete a task.
CO4:CreatecustomizedpartitionsusingLVM.
CO5:AppliestoProgramOutcomeUse– install– configure– manage– troubleshootand maintain a server operating system

TextBooks

1. LinuxAdministration:ABeginnersGuide– SixthEdition(NetworkProLibrary)– Wale Soynika **ISBN:** 0071845372– 9780071845373– **McGraw-Hill Professional**– 2015.
2. MasteringLinuxAdministration– PaulCobbaut– SecondEdition– SamuraiMediaLimited March2016– **ISBN**-13 9789888406173.

ReferenceBooks:

1 CollingsTerryandWallKurt– RedHatLinuxNetworking&System Administration– Wiley Indian– 3rd Edition– reprint 2024.
2 PetersenRichard– TheCompleteReference:Fedora7&RedHatEnterpriseLinux– Tata McGraw Hill Edition– 2025

Web Resources:

- https://access.redhat.com/documentation/en-US/Red_Hat_Enterprise_Linux/7/
- https://www.geeksforgeeks.org/what-is-linux-system-administration/
- https://training.linuxfoundation.org/training/linux-system-administration-essentials-lfs207/
- https://ubuntu.com/desktop

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Computer Graphics**					Course Code	**24BCAALE22**
	Semester	**IV**	Credits	**3**	Theory	Practical	Total Hours	**30T30P**
					2	**2**		

	COURSEOBJECTIVES
1)	Tounderstandthereal-timeapplicationofmoderncomputergraphicssystems.
2)	Understandthebasicprinciplesofimplementingcomputergraphicsprimitives. Familiarity with key
3)	algorithms for modeling and rendering graphical data.
4)	Theobjectiveistoattainprofessionalismbythestudentsintheareaofgraphicsand multimedia. Make them able to
5)	develop high quality designs– games and graphical terrains.

	GeneralInstructionsforTeaching-LearningProcess
1)	Effectiveteachingmethodscouldbeadoptedtoattaintheoutcomes.
2)	TounderstandhowtohandlegraphicsusingsystemUsevideos– onlinetools– presentation To explain the
3)	concept of graphics.
4)	Encouragecollaborative(GroupLearning)Learningintheclass.
5)	AdoptProblemBased-learning(PBL)

Module	Topics	Hours
I	**Introduction to Computer Graphics:** Introduction to Graphics systems - Basic elements of Computer –graphics Applications of computer–graphics Architecture of Raster and Random scan display devices-Input/output device(different types of display used)	6
II	**Drawing and clipping primitives:** Rasterscanline-circleandellipsedrawingalgorithms -Polygonfilling Line-clipping and polygon clipping algorithms	6
III	**Transformation and Viewing:** 2Dand3DGeometricTransformations-2Dand3DViewingTransformations (Projections- Parallel and Perspective)- Vanishing points.	6
IV	**Geometric Modeling:** PolygonMeshRepresentation-CubicPolynomialcurves(Hermiteand Bezier) - VisibleSurfacedeterminationandSurface Rendering	6
V	**Animation** Z-bufferalgorithmList-priorityalgorithm andareasubdivisionalgorithmfor visible – surface determination- Illumination and shading models-RGB color model and Basics of Computer Animation..(Latest technology used– discussaboutfuturetechnology)	6

COURSE OUTCOMES

Onsuccessfulcompletionofthecourse– studentswillbeableto:

CO1:DescribeStandardrasterandvectorsandServicesaswellasGraphicalInputandoutputdevices

CO2:Implementalgorithmsfordrawingbasicprimitivessuchaslinecircleand ellipse. CO3:Implement algorithms for line clipping and polygon clipping and filling

CO4:Implement3Dobjectrepresentationschemeandcarryout2Dand3DTransformation– 3D projections

CO5:Implementvisiblesurfacedeterminationalgorithms– Illuminationmodelsandsurfacerendering methods– colormodels.

TextBooks

1. A.V– Feiner– S.K.– &Hughes– J.F.).ComputerGraphics:PrinciplesandPracticeinC.14thedition. Addison-Wesley Professional 1995
2. "FundamentalsofComputerGraphics".16thedition.CRCPress4.Rogers– D.F.(2025).
3. ComputerGraphics:12theditionbyPradeep.KBhatiya

ReferenceBooks

1. Baker– D.H.(2024).ComputerGraphics.12ndedition.PrenticeHallofIndia.2.Foley– J.D.– Dam.

AdditionalResources:

2. Bhattacharya– S.(2024).ComputerGraphics.OxfordUniversityPress
3. Cohen– D.I.A.(2025).IntroductiontoComputerTheory.2ndedition.WileyIndia.
4. Marschner– S.– &Shirley– P.(2024)*MathematicalElementsforComputerGraphics.12thedition .McGrawHillPublications

E-LinksSources:

1. www.w3schools.com/computergraphics/
2. www.javapoint.com/cag/
3. www.tutorialspoint.com/lesson/cag.aspx/

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Debugging and Testing**					Course Code	**24BCAALE23**
	Semester	**IV**	Credits	**3**	Theory **2**	Practical **2**	TotalHours	**30T 30P**

COURSEOBJECTIVES

1) Tounderstandtheimportanceofsoftwaretestinganddebugginginthesoftware development lifecycle.
2) Toexploredifferenttypesofsoftwaretestingtechniquesandtheirapplications. To gain
3) knowledge of various debugging tools and methodologies.
4) Todevelopskillsinidentifyingandfixingsoftwaredefectsefficiently.
5) Tolearnabouttestautomationandindustry-standardtestingframeworks.

General Instructions for Teaching-Learning Process

1) Encouragestudentstoanalysereal-worldsoftwarebugsanddebuggingscenarios. Introduce open-
2) source and commercial debugging and testing tools.
3) Assign case studies on software failures and their root causes.
4) Utilizepracticalexamplestodemonstratedifferenttestingtechniques.

Module	Topics	Hours
I	**Introduction to Software Testing** Importance of software Testing in SDLC–Software Testing Life Cycle (STLC)–Principles of Software Testing–Types of Testing: Functional vs. Non-Functional Testing–Overview of Manual and Automated Testing	6
II	**Testing Techniques and Strategies** White-Box Testing: Unit Testing– Code Coverage– Control Flow– Data Flow Testing – Black-Box Testing: Equivalence Partitioning– Boundary Value Analysis– DecisionTableTesting–Grey-BoxTestinganditsApplications– Software Verification & Validation – Levels of Testing: Unit– Integration–System– and Acceptance Testing	6
III	**Debugging Techniques and Tools** Debugging Process and Strategies – Common Debugging Techniques: Backtracking– Brute Force– Cause Elimination – Debugging Tools: GDB– Win Dbg– LLDB– Post-mortem Debugging–Logging and Tracing Techniques–Debugging in Modern Software Development(Agile–DevOps)	6
IV	**Test Automation and Frameworks** Need for Test Automation–Test Automation Tools: Selenium –Continuous Integration and Testing in DevOps – Performance Testing: Load Testing– Stress Testing– Scalability Testing–Security Testing and Penetration Testing	6
V	**Emerging Trends in Debugging and Testing** AI and Machine Learning in Software Testing – Cloud-based Testing Services – Shift-left Testing Approach – Exploratory Testing vs Scripted Testing – Case Studies on Software Failures and Lessons Learned	6

COURSEOUTCOMES

At the end of the course– students will be:
CO1:Abletounderstandtheprinciplesandtechniquesofsoftwaretesting.
CO2: Proficient in identifying and applying appropriate testing methods.
CO3:Capableofdebuggingsoftwareefficientlyusingmoderntools.
CO4:SkilledinimplementingtestautomationandintegratingitintotheSDLC.
CO5: Aware of emerging trends and challenges in debugging and testing.

TextBooks

1. Glenford J. Myers– Corey Sandler– TomBadgett– "The Art of Software Testing"– 4th Edition– 2020– Wiley.
2. PaulC.Jorgensen– "SoftwareTesting:ACraftsman'sApproach"– 4thEdition– 2018– CRC Press.

ReferenceBooks

1. AdityaP.Mathur– "FoundationsofSoftwareTesting"– 2ndEdition– 2013– Pearson.
2. RexBlack– "Advanced SoftwareTesting-Vol.1– 2– 3"– 2015– RockyNook.

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Learning)**					Program Code	**24BCABAL**
	Course	**Distributed Computing for Data Science and AI**					Course Code	**24BCAALE24**
	Semester	**IV**	Credits	**3**	Theory **2**	Practical **2**	Total Hours	**30T30P**

COURSEOBJECTIVES

1) Understand the fundamentals of distributed computing.
2) Apply distributed computing techniques to solve AI/DS problems.
3) Use distributed storage and processing frameworks(e.g.– Hadoop– Spark)for large-scale data analysis.
4) Implement scalable algorithms for data pre-processing– model training– and evaluation
5) Implement large-scale data analysis workflows

General Instructions for Teaching–Learning Process

1) Set up a basic No SQL database on cloud infrastructure
2) Build and deploy a distributed AI system using cloud-based tools. Refer the
3) related concepts and tutorials from web resources.
4) Analyze a case study of a distributed AI system

Module	Topics	Hours
I	**Introduction to Distributed Computing** Definition and characteristics of distributed systems- Challenges in distributed computing: Consistency– Fault Tolerance– Scalability-Key components: Clusters– nodes– and networks- Distributed Computing Architectures: Shared Memory vs Shared Disk vs. Shared Nothing	6
II	**Distributed Data Storage and Management** Distributed File Systems and Databases - Hadoop Distributed File System (HDFS)- NoSQL Databases: Mongo DB– Cassandra– and HBase- Data Consistency and CAP Theorem- Cloud-based storage (AWSS3– Google Cloud Storage)-Data Partitioning and Shading-Data partitioning techniques: - Horizontal vs. Vertical Partitioning-Data Replication and fault tolerance-Load balancing indistributed systems	6
III	**Artificial Intelligence on Distributed Systems** Introduction to AI and Machine Learning- Supervised– unsupervised– and reinforcement learning-Distributed Deep Learning-Parallelismin Deep Learning: Data Parallelism vs. Model Parallelism-Distributed frameworks for Deep Learning: TensorFlow– PyTorch– Horovod	6
IV	**Distributed Data Science** Data Science Pipelines on Distributed Systems-Building data processing pipelines using Apache Spark-Data wrangling at scale (Spark DataFrames– Datasets)-Feature engineering on distributed systems-Advanced Data Science with Distributed Computing- Distributed Machine Learning with Apache Spark MLlib	6
V	**Applications and Case Studies** AIinReal-worldDistributedApplications-DistributedAIforautonomous systems-AI and big data applications in healthcare– finance– and e-commerce-Large-scale recommendation systems-Natural Language Processing(NLP)ondistributedsystems-Distributedsystemsinthe real	6

	world:**Cases tudies**inAI– DS– andbigdataapplications(e.g.– Google– Facebook– Netflix)-Industrial applications of distributed computing in AI/DS-Trends in distributed AI and cloud-native architectures	

COURSEOUTCOMES

At the end of the course students will be–
CO1:ToUnderstandkeyconceptsof distributed computing and its role in AI and Data Science
CO2:ToUnderstandtheconceptsofDistributedFileSystemsandDatabases
CO3:To Applymachinelearninganddeeplearningtechniquesinadistributedsetting
CO4: To Optimize data processing and model training on distributed systems
CO5:ToUnderstandandimplementlarge-scaledataanalysis workflows.

Textbooks

1. A.D.Kshemkalyani– M.Singhal– Distributed Computing: Principles– Algorithms– andSystems– Cambridge University Press– March 2011.
2. Designing Data-Intensive Applications The Big Ideas Behind Reliable– Scalable– and Maintainable Systems by Martin Kleppmann · O'Reilly Media 2017

Referencebooks

1. DeepLearningwithPythonbyFrançoisChollet2nd Edition*2021*
2. DistributedSystems:Concepts&Design5 Paperback–31March 2017
   By Coulour is George– Dollimore Jean– Kindberg Tim – BlairGordonpearson2017

Online courses:

Coursera's "Cloud Computing for Data Science" Online tutorials and documentation for Apache Spark– Tens or Flow–
Py Torch– Kubernetes Spark and Hadoop documentation

- ResearchpapersondistributedAI(availablethroughplatformslikeGoogleScholar)

	Program	**Bachelor of Computer Applications (Artificial Intelligence and Machine Language)**					Program Code	**24BCABAL**
	Course	**Big Data Analytics**					Course Code	**24BCAALE25**
	Semester	**IV**	Credits	**3**	Tutorial **2**	Practical **2**	TotalHours	**30T30P**

	COURSEOBJECTIVES
1)	ToacquiretheknowledgeofthefundamentalsofBigData– BigDataAnalytics. To implement
2)	Map Reduce programs for processing Big Data.
3)	To realize storage and processing of big data using Mongo DB. To
4)	understand and apply Hive query processing in Big Data.
5)	To implement the Spark– Text– WebContent and Link Analytics in Big Data.

	GeneralInstructionsforTeaching-LearningProcess
1)	Use of Video/Animation to explain functioning of various concepts.
2)	AskatleastthreeHOT(HigherorderThinking)questionsintheclass– whichPromotes critical
3)	thinking and encourage collaborative (Group Learning) Learning in the class.
4)	Discusshoweveryconceptcanbeappliedtotherealworld-andwhenthat'spossible– it helps improve the students' understanding.
5)	Use any of these methods: Chalk and board– Active Learning– Case Studies.

Module	**Tutorial Session**	**Topic**
I	**Introduction to BigData Analytics**	
	Session1	Classification of data–Characteristics–Evolution and definition of Big data
	Session2	Why Bigdata–Traditional Business Intelligence Vs BigData
	Session3	TypicaldatawarehouseandHadoopenvironment
	Session4	BigDataAnalytics:WhatisBigdata Analytics
	Session5	Classificationof Analytics–ImportanceofBigDataAnalytics
	Session6	TechnologiesusedinBigdataEnvironments –FewTopAnalytical Tools– NoSQL –Hadoop
II	**Introductionto Hadoop**	
	Session6	IntroductiontoHadoop:IntroducingHadoop–WhyHadoop–Why not RDBMS
	Session7	RDBMSVsHadoop–Historyof Hadoop–Hadoopoverview–Use case of Hadoop
	Session8	HDFS(HadoopDistributedFileSystem)–Processingdatawith Hadoop
	Session9	ManagingresourcesandapplicationswithHadoopYARN(YetAnother Resource Negotiator).
	Session 10	IntroductiontoMapReduceProgramming:Introduction–Mapper
	Session 11	Reducer–Combiner–Partitioner–Searching–Sorting– Compression.
III	**Introductionto MongoDB**	
	Session 12	IntroductiontoMongoDB:WhatisMongoDB–WhyMongoDB
	Session 13	TermsusedinRDBMS andMongoDB

	Session 14	DataTypesin MongoDB
	Session 15	MongoDBQueryLanguage
	Session 16	MongoDBQueryLanguage
	Session 17	CRUDoperations
	Session 18	CRUDoperations
IV	**IntroductiontoHiveandPig**	
	Session 19	IntroductiontoHive:WhatisHive–HiveArchitecture
	Session 20	Hivedatatypes–Hivefileformats–HiveQueryLanguage(HQL) RC File implementation –User Defined Function (UDF).
	Session 21	IntroductiontoPig:WhatisPig–Anatomyof Pig–PigonHadoop
	Session 22	PigPhilosophy–UsecaseforPig–PigLatinOverview–Data types in Pig
	Session 23	RunningPig–ExecutionModesofPig–HDFSCommands– Relational Operators –Eval Function
	Session 24	ComplexDataTypes–PiggyBank–UserDefinedFunction–Pig Vs Hive.
V	**Spark– BigDataAnalytics -Text– WebContentandLinkAnalytics**	
	Session 25	SparkandBigDataAnalytics:Spark
	Session 26	IntroductiontoDataAnalysiswithSpark.
	Session 27	Text–WebContentandLinkAnalytics: Introduction
	Session 28	TextMining–WebMining
	Session 29	WebContent andWebUsageAnalytics
	Session 30	PageRank –StructureofWebandAnalyzingaWebGraph.

*__Thetutorialsessiondurationis 1hourpersession.__

PRACTICALEXERCISES

Practical Session	**Topic**	**KeyLearningActivities**
Session1	HDFSCommandsand Operations	CreateadirectoryinHDFS– Uploadalocalfileto HDFS–
Session2	HDFSCommandsand Operations	ListfilesinHDFSdirectory– ReadafilefromHDFS
Session3	MapReduceProgram	Program toimplementmapreducefuntionality
Session4	RunningaHadoop MapReduce Job	LearnhowtosubmitandrunaMapReducejobon Hadoop.
Session5	MapReduceProgram	Implementmatrixmultiplicationandword count

Session6	MongoDB	createdatabase– InsertDocuments– Update Documents
Session7	MongoDB	Query/FindDocuments– TextSearch– Delete Documents
Session8	MongoDB	Relationships Queryingrelatedcollections
Session9	MongoDB	Importacsvtomongodb
Session10	Hive	ImplementNoSQLDatabaseOperations:CRUD operations– Arrays using MongoDB
Session11	Hive	ImplementFunctions:Count–Sort–Limit–Skip– Aggregate using MongoDB.
Session12	Hive	WORKINGWITHHIVEDATABASE WORKING WITH HIVE TABLE
Session13	Hive	HIVEFUNCTIONS WHERE CLAUSE GROUPBY– ORDERBY– DISTINCTJOIN
Session14	Pig	ImplementanapplicationthatstoresbigdataPig using Hadoop
Session15	Spark	.ImplementclusteringtechniquesusingSPARK.

***Thepracticalsessiondurationis2hourspersession.**

COURSEOUTCOMES

Attheendofthecoursestudents willbe–

CO1: Define and understand the core principles and challenges of Big Data.

CO2:ImplementandoptimizeMapReduceprogramstoprocesslargedatasets. CO3: Use MongoDB effectively for the storage and processing of Big Data.

CO4:ProcessBigDatawithApachePigandHivetoextractmeaningfulinsights.

CO5: Utilize Apache Spark to efficiently process and analyze Big Data– Perform text mining– Webcontentscraping– andlinkanalyticstoextractvaluableinsightsfromunstructured data.

TextBooks

1. SeemaAcharyaandSubhashiniChellappan"BigdataandAnalytics"WileyIndia Publishers– 2nd Edition– 2019.
2. RajkamalandPreetiSaxena– "BigDataAnalytics– IntroductiontoHadoop– Sparkand Machine Learning" – McGraw Hill Publication– 2019.

ReferenceBooks

1. AdamShookandDonaldMine– "MapReduceDesignPatterns:BuildingEffective Algorithms and Analytics for Hadoop and Other Systems" - O'Reilly 2012
2. TomWhite– "Hadoop:TheDefinitiveGuide"4thEdition– O'reillyMedia– 2015.
3. Thomas Erl– Wajid Khattak– and Paul Buhler– Big Data Fundamentals: Concepts– Drivers&Techniques– PearsonIndiaEducationServicePvt.Ltd.– 1stEdition– 2016–
4. JohnD.Kelleher– BrianMacNamee– AoifeD'Arcy-FundamentalsofMachineLearning for Predictive Data Analytics: Algorithms– Worked Examples– MIT Press 2020– 2nd Edition.